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UNITED STATES GOVERNMENT

memorandum

DATE:
June 26, 1990

REPLY TO ATTN OF:
Acting Supervisor, New Jersey Field Office, Pleasantville, New Jersey

SUBJECT:
1988 Environmental Contaminants Study of Great Swamp National Wildlife Refuge White-Tailed Deer

TO:
Assistant Regional Director, Refuges and Wildlife, Newton Corner, Massachusetts

Through: Assistant Regional Director, Fish and Wildlife Enhancement, Newton Corner, Massachusetts

This memo serves to document transmittal of the technical assistance report, "Contaminants in White-Tailed Deer Tissue from the Great Swamp National Wildlife Refuge, Morris and Somerset Counties, New Jersey: Results of 1988 Sampling Efforts." The study represents a team effort by the New Jersey Field Office Environmental Contaminants (EC) staff with all EC personnel involved in some aspect of study design, sampling, or interpretation.

This report was prepared for Great Swamp National Wildlife Refuge pursuant to our Scope-of-Work Agreement for Fiscal Year - 1990.

If you have any questions regarding this memo or the subject report, please contact Craig Moore of my staff.

J. C. Stott

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CONTAMINANTS IN WHITE-TAILED DEER TISSUE FROM THE GREAT SWAMP NATIONAL WILDLIFE REFUGE, MORRIS AND SOMERSET COUNTIES, NEW JERSEY

RESULTS OF 1988 SAMPLING EFFORTS

Prepared for:

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June, 1990

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PREFACE

The information presented in this report documents the 1988 environmental contaminants evaluation of white-tailed deer tissue from the resident population of the Great Swamp National Wildlife Refuge, Morris and Somerset Counties, New Jersey. This contaminants evaluation represents continuing cooperative monitoring of the refuge by Fish and Wildlife Enhancement and Refuges and Wildlife in Region 5 of the U.S. Fish and Wildlife Service. Study design, implementation, data analyses, and reporting were completed by environmental contaminants personnel of the New Jersey Field Office (Fish and Wildlife Enhancement). Funding for the project was provided by Refuges and Wildlife.

Questions, comments, and suggestions are encouraged and should be directed to the author at the following address:

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The use of trade names in this report is solely for identification purposes and is not an endorsement by the U.S. Fish and Wildlife Service or the Department of the Interior.

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ACKNOWLEDGEMENTS

This monitoring effort was designed, coordinated, and conducted by F. Timothy Prior, an environmental contaminants specialist in the New Jersey Field Office from February 1988 to March 1989 and currently with the U.S. Army at Fort Devens, Massachusetts. Prior's excellent record keeping greatly facilitated data analysis and reporting.

Sample collection was assisted by staff of the Great Swamp National Wildlife Refuge and Daniel Sparks, now with the U.S. Fish and Wildlife Service Field Office in Bloomington, Indiana.

Special thanks go to William Koch, Refuge Manager of the Great Swamp National Wildlife Refuge, for support during this investigation.

The Service also extends appreciation to the deer hunters whose voluntary participation during the Refuge deer hunt (December 8-10, 1988) helped this investigation.

Analytical work for the organic compounds was completed by the Geochemical and Environmental Research Group of the Texas A & M University. Analytical work for trace metals work was performed by the Environmental Trace Substances Research Center of the University of Missouri. A duplicate set of cadmium analyses was performed by the Freshwater Fisheries Laboratory of the New Jersey Department of Environmental Protection. The high quality of work provided by these facilities is greatly appreciated.

The author is particularly indebted to Dr. William Stansley, Wildlife Toxicologist with the New Jersey Department of Environmental Protection for expedient assistance with data interpretation.

Tom Augspurger, Elizabeth Rockwell, Michael T. Chezik, and Clifford G. Day of the New Jersey Field Office provided technical assistance in reviewing and editing this manuscript.

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EXECUTIVE SUMMARY

White-tailed deer (Odocoileus virginianus) tissues were sampled during the December, 1988, public deer hunt at the Great Swamp National Wildlife Refuge (GSNWR) to quantify levels of environmental contaminants present in the resident deer population and assess human health risks associated with consumption of venison. The study was designed to cover a range of age groups for both sexes.

Sections of 32 deer livers were analyzed for cadmium by the New Jersey Department of Environmental Protection (NJDEP). Additional sections of 30 of these deer livers were analyzed by the U.S. Fish and Wildlife Service (Service) for a full scan of trace metals. Ten samples of muscle tissue were analyzed for trace metals, organochlorine pesticides, and polychlorinated biphenyls (PCBs). Thirty samples of adipose (fatty) tissue were also sampled for organochlorine pesticides and PCBs.

The analytical data were summarized into data sets by tissue type. Maximum, minimum, mean, and median values were calculated for each constituent. Maximum and median concentrations were compared to environmental levels reported in the literature and to U.S. Food and Drug Administration (FDA) action levels to assess the levels of contamination present and their associated human health risks.

Based on quality assurance data, values for some constituents must be considered semiquantitative data. The metals aluminum and chromium showed a high degree of variability. The organics alpha BHC, beta BHC, delta BHC, and HCB had recovery rates of less than 80 percent.

Levels of organochlorine pesticides and PCBs in muscle tissue were all below detection level. Levels of metals in muscle tissue were not indicative of contamination or high enough to pose a threat to human health.

In liver tissue, where metals are selectively concentrated, the median and maximum levels of cadmium and other metals were not high enough to be indicative of contamination or to pose a threat to human health. Levels of copper observed in GSNWR liver tissue were elevated 21-66% above values observed in other studies. The median value for copper in liver samples from the GSNWR was 138 ug/g dry weight. Although there is no FDA action level established for copper, the values do not appear high enough to pose a health risk. The higher copper values were determined to be a regional phenomenon because the GSNWR copper values were only 23% greater than the background value observed in Pennsylvania. The maximum values of chromium (3.0 ug/g), cadmium (2.9 ug/g), and mercury (1.9 ug/g) were significantly, 6X, 3X, and 100X respectively, above the observed median values for these metals. Although elevated, these levels are still below FDA action levels and therefore pose no risk to human health. Additionally, they are also below levels considered indicative of environmental contamination for these metals. The maximum mercury concentration was observed in a male deer, which was the largest and one of the oldest in the survey.

A comparison of cadmium concentrations determined by graphite furnace atomic absorption method to those determined by inductively coupled emission spectroscopy revealed similar results. Overall results of the two methods were comparable.

Twenty-one of thirty (70%) adipose tissue samples tested positive for trace amounts of one or more organochlorine compounds. However, median values for individual organochlorine constituents were all below detection levels with the exception of PCB congener CL6. Overall, 17 of 32 (53%) organochlorine compounds analyzed were detected one or more times in the set of 30 adipose tissue samples. Dieldrin and various forms of chlordane, DDT, and PCBs were the most commonly encountered organochlorine compounds in the adipose tissue of deer from the GSNWR. These compounds were encountered in 13%, 37%, 23%, and 67% of the samples, respectively.

Only two of the observed maximum concentrations in adipose tissue, total PCBs (3.86 ppm) and total chlordane (0.40 ppm) exceeded FDA action levels. Both values were from the same animal, a 6 month old male from management unit 164. Furthermore, the form of chlordane in this animal indicates recent exposure to an unmetabolized form of technical grade chlordane.

All other values for total PCBs and total chlordane were well below FDA action levels for human health. However, the levels of the total PCBs are of concern because of their potential chronic toxic and carcinogenic affects on the deer.

The observed maximum concentration of dieldrin in adipose tissue was 0.27 ppm. Maximum concentrations of DDT and its metabolites were low and well below the FDA action level. This result supports the observation by Skaftason and Johannesson (1979) that there is a trend towards decreasing environmental levels of DDT and its metabolites.

Low levels of contaminants observed and lack of strong patterns in the data suggest an absence of localized contamination problems in the resident deer populations of the local management units within the GSNWR.

INTRODUCTION

The New Jersey Department of Environmental Protection (NJDEP) has documented elevated levels of cadmium in livers of white-tailed deer over 1 year old from 11 geographic areas of the State. An advisory against consumption of livers taken from older deer was issued by the NJDEP (1988). However, no samples were collected within the geographic region of the state in which the Great Swamp National Wildlife Refuge (GSNWR) is located.

This investigation was initiated to determine whether cadmium or other contaminants shown to be present in former landfills on or adjacent to the refuge are present in the resident white-tailed deer populations and whether the contaminants pose any human health risk.

OBJECTIVES

This study was designed to achieve three goals which would assist future refuge policy and management and perhaps serve as the basis for future study:

1) identify the toxics contaminants present in the resident deer population of the refuge;

2) characterize ambient concentrations of trace metals and organochlorine pesticides and PCB in white-tailed deer tissue and organs; and

3) compare these concentrations to those reported in other studies and U.S. Food and Drug Administration (FDA) action levels to determine any human health implications.

BACKGROUND

The GSNWR, formally established in 1960, consists of approximately 7,000 acres of wetlands and uplands in Morris and Somerset Counties, New Jersey (Figure 1). The refuge occupies about 20 percent of the Great Swamp watershed. Managed for wildlife and wildlife oriented education and recreation, the GSNWR provides habitat for diverse fauna and flora (U.S. Fish and Wildlife Service, 1987). Juxtaposed with this wealth of biota are several sources of pollutants within and adjacent to the GSNWR. These include two abandoned municipal solid waste landfills, satellite sites of a National Priorities List (Superfund) hazardous waste site (Asbestos Dump, Millington, New Jersey), and two sewage treatment plants (Chatham Township and Morris Woodland), which discharge into refuge headwater streams (Figure 2). Urban and agricultural runoff are also of concern in this developing area located just 25 miles from New York City (U.S. Fish and Wildlife Service, 1984).

Several studies of the GSNWR have indicated the potential for habitat and resource degradation because of the presence of xenobiotics and elevated levels of naturally occurring compounds and elements. The Miele Landfill

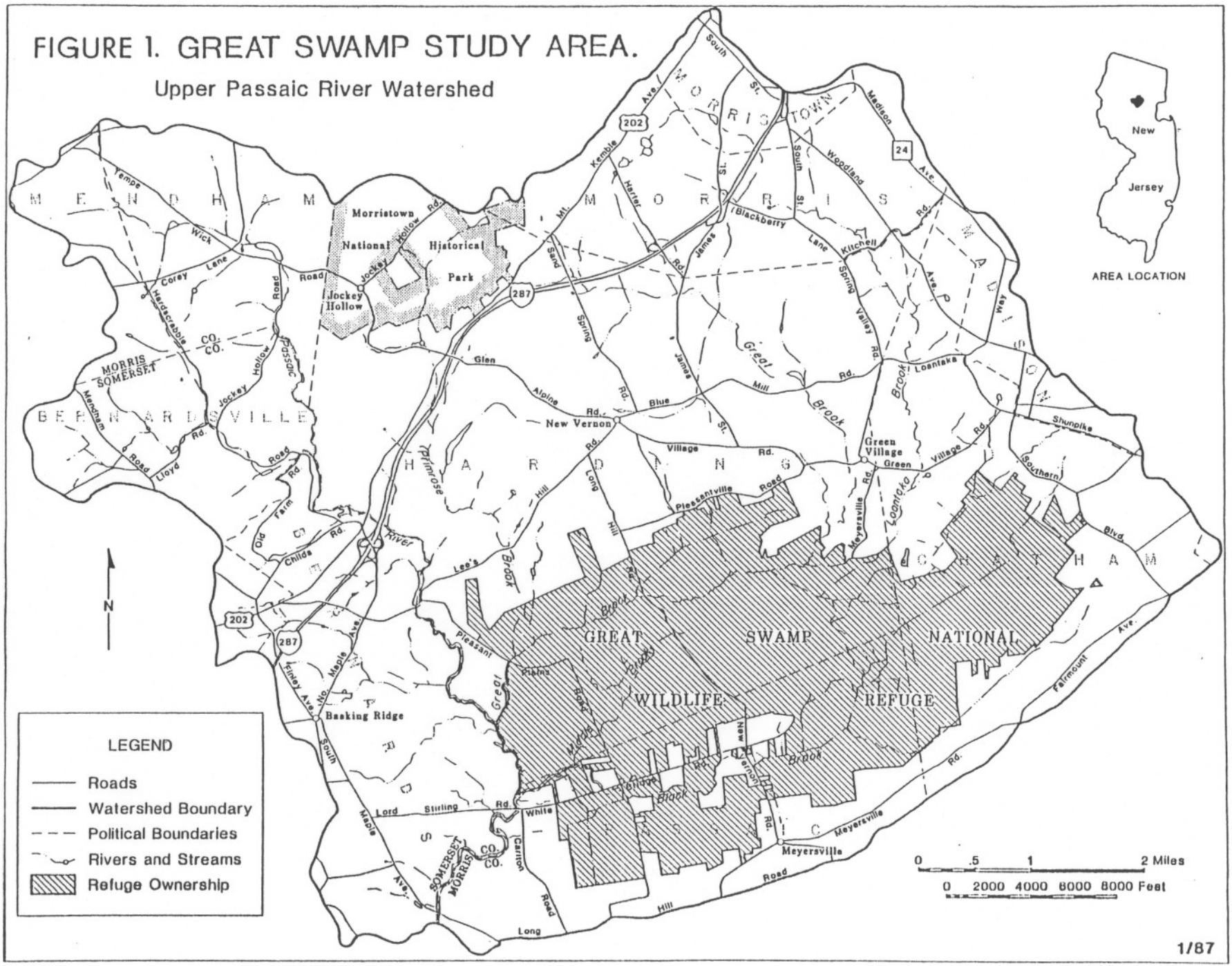
FIGURE 1. GREAT SWAMP STUDY AREA.
Upper Passaic River Watershed
AREA LOCATION
New Jersey
LEGEND
Roads
Watershed Boundary
Political Boundaries
Rivers and Streams
Refuge Ownership
GREAT SWAMP NATIONAL WILDLIFE REFUGE
Morristown National Historical Park
Jockey Hollow
Basking Ridge
New Vernon
Green Village
Meyersville
MORRISTOWN
MENDHAM
BERNARDSVILLE
HARDING
CHATHAM
MORRIS CO.
SOMERSET CO.
0 .5 1 2 Miles
0 2000 4000 6000 8000 Feet
N
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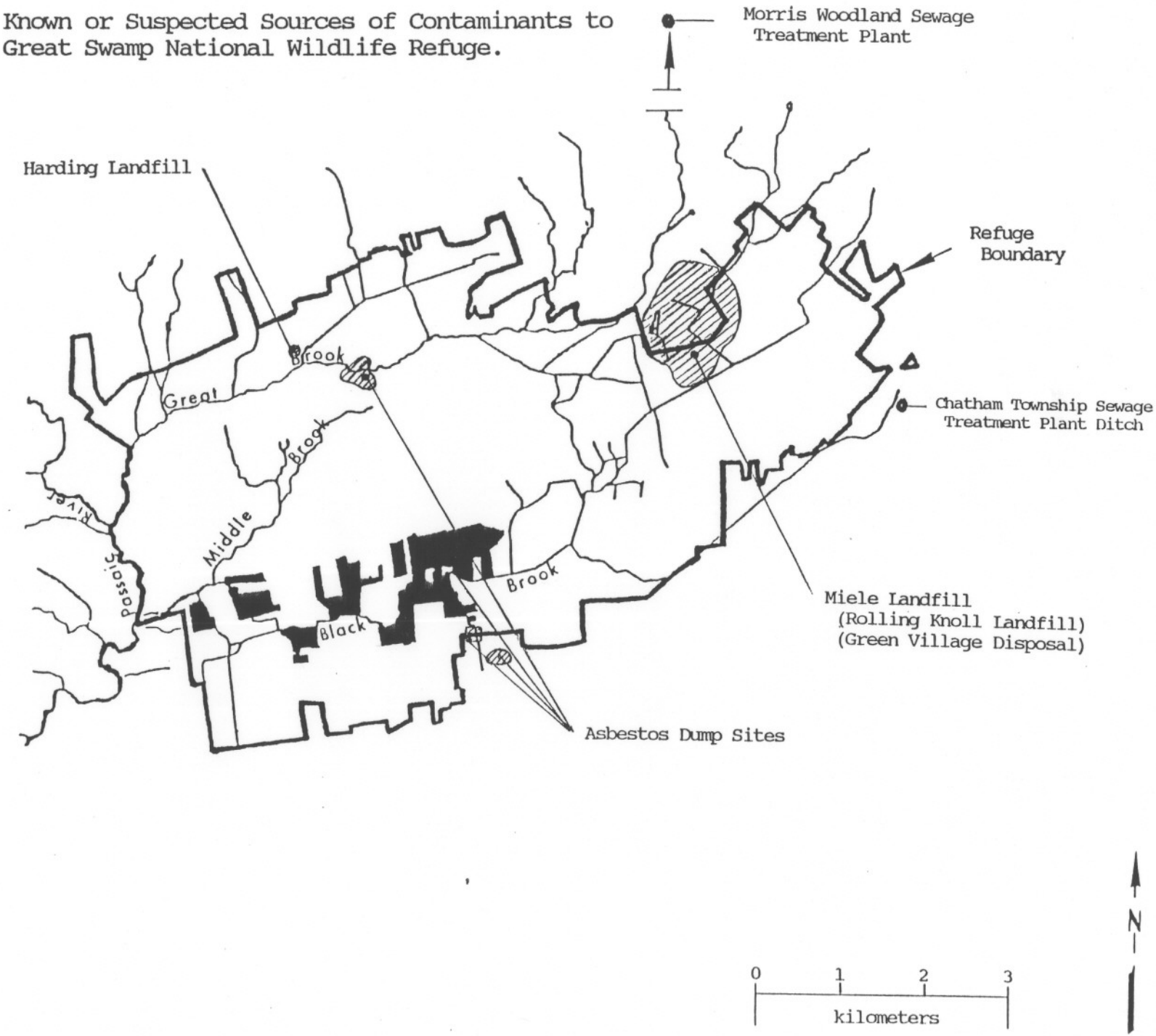
(Figure 2), also known as the Rolling Knoll Landfill, underwent an environmental audit in 1985 that identified heightened concentrations of nine heavy metals including lead and mercury and the presence of several semi-volatile compounds, polychlorinated biphenyls (PCBs), and pesticides (NUS Corporation, 1985 and 1986). This defunct sanitary landfill occupies about 135 acres of wetlands and uplands of which about 30 acres are in the Wilderness Area of the GSNWR.

A similar investigation of the 1-acre Harding Landfill (Figure 2), used for the disposal of municipal trash from 1959 to 1969, indicated the presence of low levels of polycyclic aromatic hydrocarbons and asbestos fibers (NUS Corporation, 1987). These results were based on limited sampling of the site itself, and off-site impacts are unknown.

Water quality impacts from the sewage treatment plants and urban run-off have also been documented in the watershed in the form of nutrient and chloride enrichment (Katz et al., 1986; Katz et al., 1987; Katz and Katz, 1984). The U.S. Environmental Protection Agency conducted a monitoring program to assess water quality in the Great Swamp watershed, but their approach focused on conventional water quality parameters and did not include monitoring for heavy metals, polycyclic aromatic hydrocarbons, and other potentially toxic components of urban runoff and sewage treatment plant effluent (U.S. Environmental Protection Agency, 1988).

FIGURE 2. Known or Suspected Sources of Contaminants to Great Swamp National Wildlife Refuge.



METHODS

SAMPLING DESIGN

Thirty-two samples of deer liver, fat, and muscle tissue were collected during the public deer hunt of December 8-10, 1988, at the GSNWR. Samples were solicited from hunters on a voluntary basis. Only deer that were harvested within the boundaries of the refuge were sampled. Samples were selected to cover a range of age groups for both sexes. Because this is a preliminary investigation, no particular geographic sampling design was used. However, location data for the sampled deer indicate good geographic coverage of the refuge.

SAMPLING METHODS

Samples were collected while deer carcasses were weighed at the refuge check station. One or two ounces of liver, fat, and muscle tissue were removed from selected carcasses. Fatty tissue was removed from the body wall. Muscle tissue was removed from the inside of either thigh just below the pelvis. All samples were collected, sectioned, and handled with stainless steel surgical implements and gloves. Samples were rinsed first with tap water and then with distilled water and then divided into two sections (three for liver). Samples for organics were wrapped in aluminum foil (dull side in), placed in zip lock plastic bags, labeled, and weighed. All samples were packed in coolers with dry ice and subsequently transferred to a regular freezer. Pertinent information (age, weight, sex, and location) for each deer was recorded on the sample forms.

ANALYTICAL METHODS

Inorganic analyses for trace metals in deer tissues were performed at the Environmental Trace Substances Research Center of the University of Missouri. All trace metals except mercury were analyzed via inductively coupled plasma emission spectroscopy (ICP). Mercury was determined by cold vapor reduction atomic absorption spectroscopy (CVA).

A duplicate set of inorganic analyses for cadmium in deer liver were performed at the Freshwater Fisheries Laboratory of the New Jersey Department of Environmental Protection (NJDEP). These samples were analyzed with a graphite furnace atomic absorption unit.

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Organic analyses were performed at Texas A&M Research Foundation of Texas A&M University. The quantitative analyses were performed by capillary gas chromatography (CGC) with electron capture detector for pesticides and PCBs.

Detailed descriptions of all applied analytical methodologies are provided in Appendix A along with sample preparation procedures (subsampling, homogenization, extraction, cleanup, digestion, and preconcentration). The procedures for dry weight, ash weight, percent moisture, and lipid determination are also described in detail.

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RESULTS AND DISCUSSION

DEER SAMPLING DATA

Figure 3 shows the location of the local state deer management units in relation to the refuge boundary and known or suspected sources of environmental contaminants on the GSNWR. It also shows the number of sampled deer by management unit and sample distribution. Geographic coverage of the refuge was adequate. Three of the four deer management units were sampled. Management unit 147, which covers the smallest portion of the refuge was not sampled. Distribution of the sampled deer was uniform on a proportional area basis. The majority of samples were from management unit 164 however, because it contained the largest area of the refuge.

Deer home ranges vary with region and sex. Deer in the GSNWR are characterized as an urban population and as such, tend to have restricted home ranges. Does have elliptical shaped home ranges of approximately 1-2 miles in area. Bucks have larger home ranges, especially during the rutting season (Taylor, Leenhouts, pers comm.).

Recent telemetry studies have shown that deer are almost always harvested inside their home range. Hunting makes deer more active within their home range but, rarely moves them outside of it (Leenhouts, pers. comm.). This behavior makes it feasible to define patterns of contamination in the local deer population.

Table 1 shows a breakdown of deer sampled by age and sex. The age denotes the midpoint of each age group with exception of the last age group. This group contains all deer two years old and older. Age determination of deer over 2 years is more complicated and less reliable. These particular age groups are often used and were selected for this study because they can be easily and reliably distinguished. (NJDEP, 1988; New York State Conservationist, 1965). As shown in Table 1, distribution of the deer by age and sex was uniform except for the 2 1/2-year category, which was skewed towards a larger number of females.

CONTAMINANTS DATA

Sections of 32 deer livers were analyzed for cadmium content by the NJDEP. Additional sections of 30 deer livers were analyzed by the Service for a full scan of trace metals. Ten samples of muscle tissue were analyzed for trace metals, organochlorine pesticides, and PCBs. Thirty samples of adipose (fatty) tissue were also sampled for organochlorine pesticides and PCBs.

Tables 2 and 3 present summary data and statistics for trace metals in muscle and liver tissue, respectively, from the GSNWR white-tailed deer. Table 4 shows a comparison of cadmium results determined by different laboratory methodologies. Tables 5 and 6 present summary data and statistics for organochlorine pesticides and PCBs in muscle and adipose tissue, respectively. The information presented in tables 2,3,5, and 6 are the minimum, maximum, median, and mean values for each of the listed constituents. Generally, the

Figure 3. New Jersey State Deer Management Units in Relationship to the Refuge Boundary and Known or Suspected Sources of Environmental Contaminants to the Great Swamp National Wildlife Refuge. (Total Equals Number of Sampled Deer)

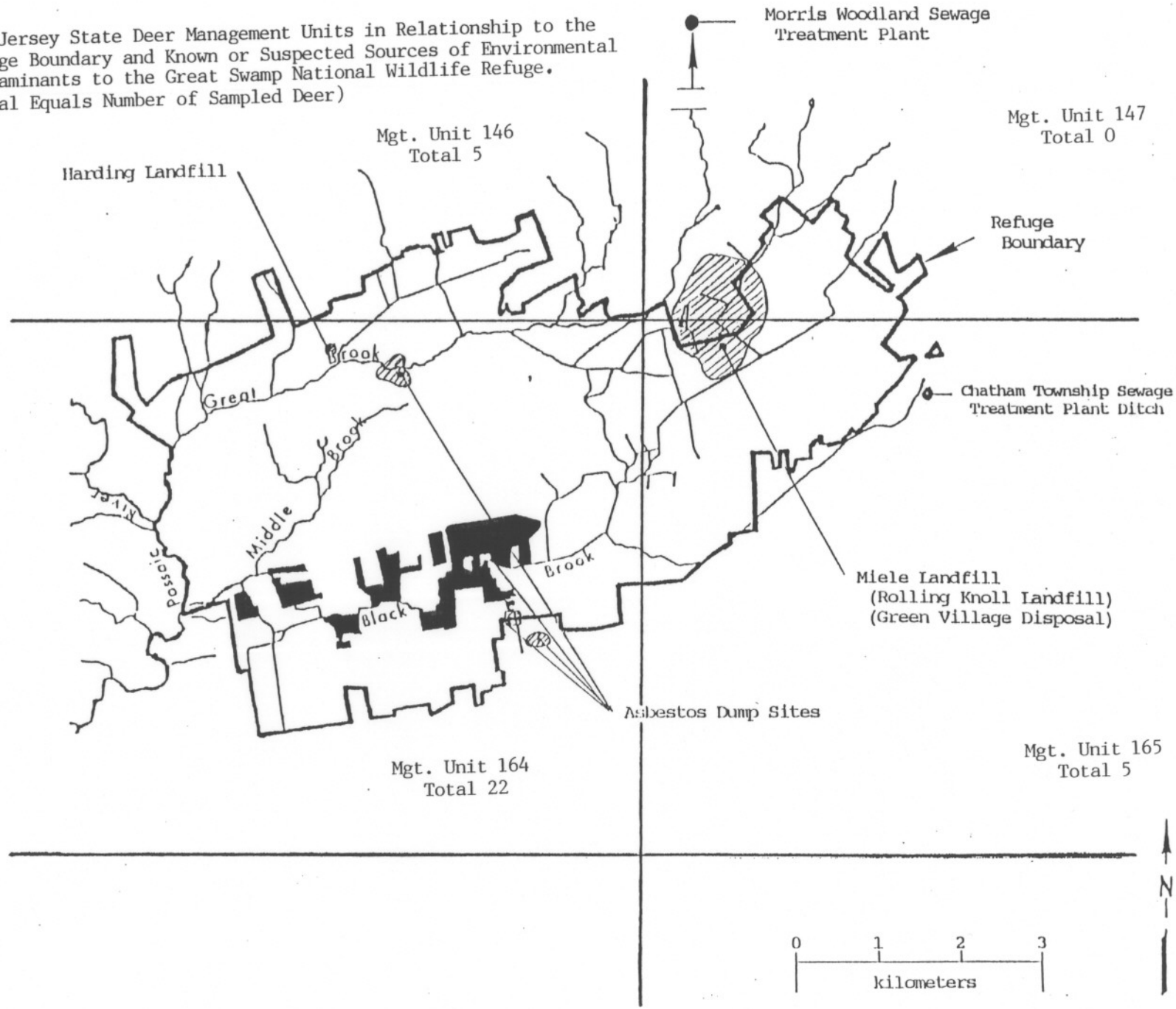

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Table 1. White-Tailed Deer Samples from Great Swamp National Wildlife Refuge by Age and Sex

AGE* (YR) SAMPLES	MALE SAMPLE NUMBERS (R5DFGWLI-##)	MALE NUMBER OF SAMPLES	FEMALE SAMPLE NUMBERS (R5DFGWLI-##)	FEMALE NUMBER OF SAMPLES	TOTAL NO. OF
1/2	01,05,11,15,16,	7	04,06,18,29,30	5	12
1 1/2	02,08,12,17,31, 32	6	14,20,26,27	4	10
2 1/2+	23,28	2	03,07,09,10,13 19,22,25	8	10
		15		17	32

* Denotes midpoint of age group except for last age group, which contains all deer two years of age and older.

median and statistical mean should be similar. When they are not, the statistical mean is significantly skewed, towards the high side in our data sets, by an outlying data point (outlier). Although outliers are significant, they do not represent the true character of the data set. In such cases, it is better to rely on the median to assess the true character of the data set.

All metal concentrations are expressed as micrograms per gram of dry sample weight (ug/g dry weight). Values for aluminum and chromium must be considered semiquantitative data because quality assurance data for these particular constituents show a high degree of variability (Appendix C). All organochlorine compound concentrations are expressed as parts per million of wet sample weight (ppm/wet weight). Data for alpha BHC, beta BHC, delta BHC, and HCB, which were basically all below detection level, should be considered semiquantitative because quality assurance data for these particular constituents showed an average recovery rate of less than 80 percent (Appendix C).

Metals

In the muscle tissue the median values of beryllium, cadmium, nickle, lead, and thallium were not above detection level (Table 2). Beryllium, thallium, and lead were not found above detection levels in any of the muscle tissue samples. Median values for aluminum, chromium, manganese, and mercury were all close to detection level. Aluminum and chromium both had high maximum values, although not in the same sample. However, the large difference between the mean and median indicates these values are outliers. Because of the high degree of variability associated with the aluminum and chromium analyses, the validity of these values is questionable. Iron, copper, and zinc concentrations were much higher than other measured constituents, which is to be expected for trace elements.

In the liver tissue, the median values of beryllium, thallium, and lead were not above detection level (Table 3). Beryllium was the only trace metal not detected in any of the liver samples. Median values for aluminum, chromium, nickle, and mercury were all close to the detection levels. The maximum concentration for aluminum was much lower in liver tissue than in muscle tissue, 2.0 versus 16.0 ug/g, respectively. Most heavy metals are selectively concentrated in the liver and kidney tissues (Munshower and Neuman, 1979). The validity of the higher maximum value (16.0) from the muscle tissue is therefore, questionable.

As expected, iron, manganese, copper, and zinc concentrations were higher than other measured constituents. Because they are essential trace metals, these concentrations are of little concern. Most studies did not consider iron and manganese concentrations. Zinc values were comparable to those observed in other studies (Sileo and Beyer, 1985; Woolf et al., 1982; Munshower and Neuman, 1979; King et al., 1984). Copper concentrations in GSNWR liver tissue were elevated 21-66% above values observed in these studies. Although there is no U.S. Food and Drug Administration (FDA) action level established for copper, the values do not appear high enough to pose a health risk (Stansley,

Table 2. Summary of Ambient Concentrations of Trace Metals in Deer Muscle Tissue from Great Swamp National Wildlife Refuge (all values in ug/g dry weight; n =10)

	AL *	BE	CD	CR *	CU	FE	MN	NI	PB	TL	ZN	HG
MINIMUM	<0.4	<0.01	<0.04	0.3	5.51	75.7	0.5	<0.4	<0.5	<0.5	42.2	0.006
MAXIMUM	16	<0.01	0.05	5.2	8.32	143	1.4	3.0	<0.5	<0.5	142	0.009
MEAN	2.6	<0.01	0.02	1.1	6.34	111	0.8	0.5	<0.5	<0.5	81.3	0.008
MEDIAN	0.6	<0.01	<0.04	0.5	6.14	110	0.7	<0.4	<0.5	<0.5	77.3	0.008

* The precision for these analytes, as measured by duplicate sample analysis, was low due to a high degree of variability See QA report in appendix B-1 for further information

Table 3. Summary of Ambient Concentrations of Trace Metals in Deer Liver Tissue from Great Swamp National Wildlife Refuge (all values in ug/g dry weight; n =30)

	AL*	BE	CD	CR*	CU	FE	MN	NI	PB	TL	ZN	HG
MINIMUM	<0.4	<0.01	0.22	<0.1	8.47	187	8.48	<0.4	<0.5	<0.5	73	0.008
MAXIMUM	2.2	<0.01	2.9	3.0	367	665	17.5	1.8	0.6	0.5	165	1.9
MEAN	1.0	<0.01	1.3	0.7	157	356	12.1	0.4	0.2	0.2	114	0.09
MEDIAN	0.9	<0.01	1.2	0.5	138	342	12.0	0.4	<0.5	<0.5	115	0.02

* The precision for these analytes, as measured by duplicate sample analysis, was low due to a high degree of variability See QA report in appendix B-1 for further information

1989). The higher copper values were determined to be a regional phenomenon, because GSNWR copper values were only 23% greater than the background value observed in Pennsylvania by Sileo and Beyer (1985). There are no similar data sets from New Jersey for comparison (Stansley, pers. comm.).

The high maximum values of chromium (3.0 ug/g), cadmium (2.9 ug/g), and mercury (1.9 ug/g) were notable because they were significantly higher than observed median values. Mercury was 100X higher than the observed median value and chromium, 6X higher than the median value. The maximum value for cadmium was only 3X higher than the median value.

The maximum value for mercury was 1.9 ug/g dry weight, which is equivalent to 0.57 ppm fresh weight. This value is well below the FDA action level of 1.0 ppm fresh weight in fish tissue and does not pose a serious human health risk (Stansley, 1989). The significance of elevated levels of mercury in tissue of fish and wildlife is not fully understood. Usually, concentrations in excess of 1.1 ppm fresh weight in liver tissue should be considered as presumptive evidence of an environmental mercury contamination problem (Eisler, 1987). Based on this criterion, there is little evidence of mercury contamination of the resident deer population of the GSNWR. The maximum value reported for cadmium was 2.9 ug/g dry weight, which is equivalent to 0.90 ppm fresh weight. This value is well below the NJDEP action level of 1.5 ppm fresh weight and therefore does not pose a human health risk (Stansley, 1989). Eisler (1985) states that cadmium residues in vertebrate liver that exceed 10 ppm fresh weight should be viewed as presumptive evidence of cadmium contamination. Based on this criterion there is little evidence of cadmium contamination among the resident deer population of the GSNWR. There has not been a FDA or NJDEP action level established for chromium (Stansley, pers. comm.). Tissue levels in excess of 4.0 mg total Cr/kg dry weight should be viewed as presumptive evidence of chromium contamination. The significance of these levels in tissue is still unclear (Eisler, 1986a). The maximum value for chromium observed in deer liver from the GSNWR was 3.0 ug/g (3.0 mg/kg), which is below the level indicating contamination.

Analysis of metals data revealed some notable patterns. Most of the maximum concentrations for metals in muscle tissue are from two deer. Sample #9 had maximum values for cadmium, chromium, iron, manganese, and nickle. Sample #9 also had the highest copper concentration among liver tissues. Sample #22 had the highest concentrations of aluminum, cadmium, nickle, and zinc in the muscle tissue data set. This sample also had the second highest iron concentration in the data set. Sample #9 was from the oldest female (4 1/2 years) in the study and had a field dressed weight of 88 pounds. Sample #22 was from the largest female (107 lbs. field dressed) in the second oldest age group (3 1/2 years) in the sample set. Both of these animals came from management unit 164.

Patterns in maximum metal concentrations were not as evident in the liver data. The maximum cadmium concentration (2.9 ug/g) was in sample #25, which was from a 2 1/2-year-old female with a field dressed weight of 82 pounds that came from management unit 165. Maximum concentrations of chromium (3.0 ug/g)

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and nickel (1.8 ug/g) were in sample #7, which was from a 2 1/2-year-old female with a field dressed weight of 78 pounds from management unit 164. The maximum concentration of copper (367 ug/g) was in sample #9, which also had a fairly high cadmium concentration (2.7 ug/g). This is the same animal that had the maximum concentrations of cadmium, chromium, iron, manganese, and nickle in muscle tissue. Notably, the copper concentration (6.67 ug/g) in muscle tissue from this animal (#9) was not particularly high (i.e., not significantly above the median value of 6.14 ug/g).

The maximum concentration of mercury (1.9 ug/g) was in sample #28, which was taken from one of the two oldest males (2 1/2 years). This animal had a field dressed weight of 122 pounds, the largest in the study, and was from management unit 164. Although below the FDA action level, this was probably the most significant metal concentration observed because it was about 100X higher than the observed median value for the data set. The only other 2 1/2-year-old male in the study had the lowest concentrations of mercury (.008 ug/g) in the liver data set. However, this animal was from a different management unit (146). The next highest concentration of mercury (0.32 ug/g) was found in a 41-pound female that was only 6 months old. This animal was also taken in management unit 164. The rest of the deer from this management unit (164) had low concentrations of mercury. Complicating the interpretation of these values, sample #28, which had the maximum mercury concentration, was from a male. Males have much larger ranges, especially during the rutting season. Therefore, it was difficult to determine if there is a localized mercury contamination problem in management unit 164.

The larger number of maximum metals concentrations in deer management unit 164 may also be in part due to the larger sample number for this particular management unit. The larger sample size increases the probability of a wider range of values for any given constituent, and thus makes it difficult to determine if there is a localized problem with metal contaminants in management unit 164. However, all maximum levels of metals observed in the study are below levels that indicate contamination problems. Therefore, it is unlikely there is a contaminant (metals) problem in the GSNWR portion of deer management unit 164.

Table 4 presents a comparison of the cadmium concentrations determined by graphite furnace atomic absorption method (NJDEP lab) as opposed to those determined by inductively coupled emission spectroscopy method (University of Missouri lab). Analyses were performed on split samples (livers) that were divided prior to homogenization. Results were comparable except for the three values marked with an asterisk (*). Even these pairs of values were close for this type of comparison. Overall, the results of these two methods were closely comparable (Augspurger, 1989).

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Table 4. Comparison of Cadmium Values from Split Samples Analyzed by the New Jersey Department of Environmental Protection (NJDEP), Freshwater Fisheries Laboratory and University of Missouri, Environmental Trace Substances Research Center

SAMPLE NUMBER	DEER MANAGEMENT UNIT	NJDEP LAB CD CONC$ DRY WEIGHT (UG/G) n =32	MISSOURI RESEARCH CENTER CD CONC# DRY WEGHT (UG/G) n =30	AGE (YRS)	FIELD WEIGHT (LBS)	SEX
11	164	0.16	0.22	0.5	52	M
18	164	0.32	0.36	0.5	53	F
24	146	0.41	0.41	0.5	42	M
6	164	0.43	0.42	0.5	52	F
32	146	0.47 *	0.7 *	1.5	102	M
1	164	0.53	--	0.5	35	M
21	164	0.62	0.68	0.5	60	M
28	164	0.68	1	2.5	122	M
29	164	0.78	0.65	0.5	41	F
30	146	0.83	0.98	0.5	54	F
13	164	0.99	0.92	3.5	93	F
22	164	1.08	1.1	3.5	107	F
16	164	1.1	1.1	0.5	52	M
26	165	1.11	1.2	1.5	62	F
5	164	1.16	--	0.5	42	M
17	165	1.19	1.1	1.5	74	M
27	164	1.2	1.3	1.5	90	F
15	164	1.24	1.2	0.5	58	M
31	165	1.26	1.4	1.5	114	M
4	164	1.27	1.5	0.5	40	F
12	164	1.3	1.2	1.5	80	M
19	164	1.41	1.6	2.5	88	F
2	164	1.57 *	2.2 *	1.5	82	M
8	165	1.61	1.7	1.5	85	M
3	164	1.67	1.6	2.5	88	F
7	164	1.82	1.8	1.5	74	M
14	146	2.16	2.1	1.5	62	F
20	164	2.33	2.4	1.5	78	F
9	164	2.38	2.7	4.5 +	88	F
23	146	2.46 *	1.1 *	2.5	105	M
10	164	2.55	2.7	3.5	93	F
25	165	2.81	2.9	2.5	82	F

$ Determined by graphite furnace atomic absorption
# Determined by inductively coupled plasma emission spectroscopy
* Data pairs showing a higher degree of variability

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Organics

Organochlorine pesticides and PCBs were below detection levels in all of the deer muscle tissue samples. Table 5 presents the organochlorine compounds analyzed in muscle tissue and their respective detection levels. These low levels are not too surprising since organochlorine compounds tend to accumulate in adipose tissue and the muscle tissue analyzed had a fairly low fat content (0.84-2.57% lipids in the 10 samples analyzed). Because of the low fat content and low associated contaminant level, there appears to be little human health hazard associated with the venison of deer from the GSNWR (Stansley, 1989).

Table 6 presents the minimum, maximum, mean, and median values for each of the organochlorine compounds analyzed in adipose (fatty) tissue of deer from the GSNWR. The detection levels for organochlorine compounds in muscle tissue were actually lower than those for adipose tissue, 0.01 and 0.10 versus 0.05 and 0.50 respectively, due to the smaller sample volumes of the adipose tissue samples.

Table 6 also presents the number of samples that tested positive and the rate of occurrence (expressed as a percentage) for each of the organochlorine compounds detected. Overall 17 out of 32 (53%) of the organochlorine compounds analyzed were detected one or more times in the set of 30 adipose tissue samples.

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Table 5. Summary of Organochlorine Residues in Muscle Tissue of White Tailed Deer from GSNWR (all values ug/g wet weight; n=10)

COMPOUND	MUSCLE TISSUE MAXIMUM CONC.
a-BHC	ND
HCB	ND
b-BHC	ND
g-BHC (lindane)	ND
d-BHC	ND
Total BHC's	ND
heptachlor	ND
aldrin	ND
heptachlor epoxide	ND
oxychlordane	ND
g-chlordane	ND
a-chlordane	ND
trans-nonachlor	ND
dieldrin	ND
endrin	ND
cis-nonachlor	ND
mirex	ND
o,p'-DDE	ND
p,p'-DDE	ND
o,p'-DDD	ND
p,p'-DDD	ND
o,p'-DDT	ND
p,p'-DDT	ND
Total Cl2 biphenyls	ND
Total Cl3 biphenyls	ND
Total Cl4 biphenyls	ND
Total Cl5 biphenyls	ND
Total Cl6 biphenyls	ND
Total Cl7 biphenyls	ND
Total Cl8 biphenyls	ND
Total Cl9 biphenyls	ND
Total PCB's	ND
toxaphene	ND

ND = none detected at stated level of detection
Level of detection = 0.01 except for Total PCB's and toxaphene (0.10)

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Table 6. Summary of Organochlorine Residues in Adipose (Fatty) Tissue of White Tailed Deer from GSNWR
(all values ug/g wet weigh; n=30)

COMPOUND	MINIMUM	MAXIMUM	MEAN	MEDIAN	OCCURRENCE #SAMPLES	OCCURRENCE RATE
a-BHC	ND	ND	ND	ND	0	0
HCB	<0.05	0.05	<0.05	<0.05	1	3%
b-BHC	ND	ND	ND	ND	0	0
g-BHC (lindane)	ND	ND	ND	ND	0	0
d-BHC	ND	ND	ND	ND	0	0
Total BHC's	ND	ND	ND	ND	0	0
heptachlor	ND	ND	ND	ND	0	0
aldrin	ND	ND	ND	ND	0	0
heptachlor epoxide	ND	ND	ND	ND	0	0
oxychlordane	<0.05	0.19	<0.05	<0.05	10	33%
g-chlordane	<0.05	0.19*	<0.05	<0.05	1	3%
a-chlordane	<0.05	0.12*	<0.05	<0.05	1	3%
trans-nonachlor	<0.05	0.09*	<0.05	<0.05	1	3%
dieldrin	<0.05	0.27	<0.05	<0.05	4	13%
endrin	ND	ND	ND	ND	0	0
cis-nonachlor	ND	ND	ND	ND	0	0
mirex	ND	ND	ND	ND	0	0
o,p'-DDE	<0.05	0.05	<0.05	<0.05	1	3%
p,p'-DDE	ND	ND	ND	ND	0	0
o,p'-DDD	<0.05	0.23*	<0.05	<0.05	2	7%
p,p'-DDD	ND	ND	ND	ND	0	0
o,p'-DDT	<0.05	0.06*	<0.05	<0.05	1	3%
p,p'-DDT	<0.05	0.09	<0.05	<0.05	5	17%
Total Cl2 biphenyls	ND	ND	ND	ND	0	0
Total Cl3 biphenyls	<0.05	0.10	<0.05	<0.05	2	7%
Total Cl4 biphenyls	<0.05	2.13	0.12	<0.05	6	20%
Total Cl5 biphenyls	<0.05	0.83	0.08	<0.05	10	33%
Total Cl6 biphenyls	<0.05	0.90	0.13	0.075	20	67%
Total Cl7 biphenyls	<0.05	0.15	<0.05	<0.05	2	7%
Total Cl8 biphenyls	<0.05	0.05	<0.05	<0.05	1	3%
Total Cl9 biphenyls	ND	ND	ND	ND	0	0
Total PCBs	<0.50	3.86*	<0.05	<0.05	6	20%
toxaphene	ND	ND	ND	ND	0	0

ND = none detected at stated level of detection
Level of detection = 0.05 except for Total PCB's and toxaphene (0.5)
* Value confirmed by GC/MS

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The organochlorine compounds most commonly encountered as contaminants in adipose tissues of deer from the GSNWR were dieldrin and various forms of chlordane, DDT, and PCB's. These compounds were encountered in 13%, 37%, 23%, and 67% of the samples, respectively. Frequency of occurrence for all compounds, isomers, and individual metabolites are reported in Table 6.

Twenty-one out of 30 (70%) of the adipose tissue samples tested positive for trace amounts of one or more of the organochlorine compounds. However, median values for individual organochlorine constituents were all below detection levels with one exception. The median value for the PCB congener (CL6) was 0.075 ppm/fresh weight. This value is well below the FDA action level of 3.0 ppm for total PCBs in red meat/fat basis (FDA, 1987). Eisler (1986b) states that biological responses to individual PCB isomers or mixtures vary widely. Therefore, at this time, total PCB residues give a more reliable measure of environmental contamination than do measurements of individual aroclors or other commercial mixtures. The median value for total PCBs in adipose tissue was below detection level and consequently well below the FDA action level.

Only a few adipose tissue samples were significantly above detection levels. Most notable was sample #15, which had the maximum observed concentrations for gamma (trans) chlordane, alpha (cis) chlordane, trans nonachlor, O,P'DDD, O,P'DDT, biphenyl CL4, biphenyl CL5, biphenyl CL6, and total PCBs. This animal was a 6-month-old male with field dressed weight of 58 pounds from management unit 164. Of all maximum concentrations, only the values for total PCBs (3.86 ppm) and total chlordane (0.40 ppm) exceeded the FDA action levels of 3.0 ppm in red meat/fat basis and 0.3 ppm in fish tissue respectively. This was the only animal in the data set that contained concentrations above FDA action levels.

The form of the chlordane present in sample (animal) #15 was unusual. Chlordane was present in high concentrations of gamma (trans) chlordane (0.19 ppm), alpha (cis) chlordane (0.12 ppm), trans nonachlor (0.09 ppm). These are primary components in technical grade chlordane. Oxychlordane, which is the principle toxic breakdown metabolite of chlordane and the most commonly observed form, was below detection level in this animal.

Chlordane in the remaining deer was observed at low levels and only in the form of oxychlordane. This is consistent with observations of Eisler (1990) that in most mammals, the breakdown metabolite oxychlordane has proven much more toxic and persistent than the parent compound (chlordane). Coupled with the young age of animal #15 (6 months), these results indicate recent exposure of this animal to an unmetabolized form of technical grade chlordane.

Chlordane is readily absorbed and distributed throughout the body of warm-blooded animals via the skin, diet, and inhalation. Residues of chlordane and its metabolites are not measurable in tissue 4 to 8 weeks after exposure, although metabolism rates very significantly between species (Eisler, 1990). Except for control of underground termites, chlordane use in the United States has been prohibited since 1983. The half life of chlordane in water is short. In soils, however, some chlordane isomers persist for 3-14 years (Eisler, 1990).

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The remaining levels of chlordane in the data set were in the form of oxychlordane. Whereas oxychlordane was in a total of 10 samples (33%) most of the values were low. The maximum observed concentration for oxychlordane was 0.19 ppm fresh weight. Only a total of 5 of the samples, including the maximum, exceeded a concentration of 0.10 ppm fresh weight. All of the values for oxychlordane, including the observed maximum, were below the FDA action level of 0.3 ppm fresh weight in fish tissue established for total chlordane or its individual components (FDA, 1987). Because of an inadequate and incomplete data base, this is the best existing criterion for the protection of birds and mammals (Eisler, 1990). Chlordane has produced liver cancer in laboratory strains of domestic mice, but carcinogenicity has not been established in other mammals (Eisler, 1990).

Total PCBs were above detection level in 5 adipose tissue samples. The second and third highest levels of PCBs were observed in sample #13 (1.30 ppm) and sample #6 (1.09 ppm). Sample #13 was from a 3 1/2-year-old female with a field dressed weight of 93 pounds from management unit 164. Sample #6 was from a 6-month-old female with a field dressed weight of 58 pounds also from management unit 164. The remaining total PCB values were 0.77, 0.58, and 0.51 ppm from samples #7, #21, and #14 respectively. The first two samples were from management unit 164 and the last was from unit 146. These values are well below the FDA action levels for human health, however, they are of concern because of their potential chronic toxic and carcinogenic affects on deer.

PCBs elicit a variety of biologic and toxic effects including birth defects, reproductive failure, liver damage, tumors, wasting syndrome, and death. They are known to bioaccumulate and biomagnify within the food chain (Eisler, 1986b). Eisler (1986b) also notes that among sensitive species of bony fishes, total PCB residues in excess of 400 ppb (0.4 ppm) in whole body were demonstratably harmful, and should be considered as presumptive evidence of significant PCB contamination. Among small mammals, the mink (Mustela vision) is one of the most sensitive species. Dietary levels as low as 100 ppb (0.1 ppm) total PCBs per fresh weight caused death and reproductive toxicity in mink. Unfortunately, these criteria are not directly comparable to the levels of PCBs observed in the adipose tissue of white-tailed deer from the GSNWR. However, they may serve as a general guide since there is no specific criteron for the toxicological effects of PCBs on white-tailed deer at the present time. The examples help to illustrate the high potential for toxic effects of even small amounts of PCBs.

The highest concentration of dieldrin (0.27 ppm) was observed in sample #23, which was from a 2 1/2-year-old male with a field dressed weight of 105 pounds from management unit 146. There currently is not an FDA action level established for dieldrin. However, the value does not appear high enough to be a cause for concern.

Concentrations of DDT and its metabolites observed in the adipose tissue were all at or close to detection level. Maximum observed concentrations were O,P'DDE (0.05 ppm), P,P'DDE (<0.05 ppm), O,P'DDD (0.23 ppm), P,P'DDD (<0.05

ppm), O,P'DDT (0.06 ppm), and P,P'DDT (0.09 ppm). These values were all well below the FDA action level of 5.0 ppm fresh weight established for DDT and DDE in edible fish tissue and, therefore, do not pose a serious human health risk (Stansley, 1989). These values are also low enough to not pose any long term chronic health effects to deer. Maximum concentrations of DDT and its metabolites observed in adipose tissue of white-tailed deer from the GSNWR were much lower than mean concentrations observed by Barrier et al. (1970) and Cotton and Herring (1970).

The maximum concentrations observed at the GSNWR were very comparable to the mean concentrations observed by Benson and Smith (1972) in his 1969 sampling of mule deer (Odocoileus hemionus) in the Salmon National Forest in Idaho. In Benson's study, spraying in the National Forest ceased in 1964. Our results tend to support the observation of Skaftason and Johannesson (1979) that there is a definite trend towards decreasing environmental levels of DDT and its metabolites.

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CONCLUSIONS / RECOMMENDATIONS

1.) Levels of cadmium and other environmental contaminants observed in the resident deer population of the GSNWR were low and not indicative of serious environmental contamination. The levels do not pose a serious threat to human health.

2.) Further investigation of the environmental contaminant levels in the resident deer population is not warranted at this time.

3.) Follow-up investigation of contaminant levels in the deer population in 5-10 years would be beneficial in assessing and documenting changes in the environmental contaminant levels, particularly PCBs, of the resident deer population of the GSNWR. The following suggestions are offered for consideration in any future investigation.

- o Do not field rinse tissue samples with tap water prior to packing to avoid a possible source of sample contamination prior to analysis. If field rinsing is necessary use distilled/deionized water only and run a few analyses on wash water blanks for quality assurance purposes.

- o Clean/rinse all stainless steel sampling and dissection implements with nitric acid and/or acetone and double rinse with distilled/deionized water between samples to avoid possible cross-contamination. Run analyses on a few wash water blanks if not already included in the quality assurance program.

- o Use some type of geographical sampling scheme to ensure a more complete and uniform coverage of the refuge. This will allow for further and more complete analysis and interpretation of the resulting data.

4. Future investigation of bioaccumulation and bioconcentration of environmental contaminants at GSNWR should be oriented towards metals accumulation by local flora and organics, and metals accumulation in the lower trophic levels of the food chain.

- o Consideration should be given to including arsenic, barium, and silver in any future metals analyses if a pathway for their accumulation exists. Elevated levels of these metals have been documented on the GSNWR.

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PERSONAL COMMUNICATIONS

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ANALYTICAL METHODS

(A-1)

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Let's protect our earth

State of New Jersey

DEPARTMENT OF ENVIRONMENTAL PROTECTION

DIVISION OF
FISH, GAME AND WILDLIFE
GEORGE P. HOWARD
DIRECTOR

PLEASE REPLY TO:
CN 400
TRENTON, NEW JERSEY 08625

Freshwater Fisheries Laboratory
PO Box 394
Lebanon, NJ 08833

August 18, 1989

Michael Chezik
US Fish and Wildlife Service
PO Box 534
705 White Horse Pike
Absecon, NJ 08201

Dear Mike:

Enclosed are the results of the Cd analyses we performed on the 32 deer liver samples that were submitted to our lab in March 1989. I have also included a description of the analytical method and the results of QA/QC analyses that were performed.

We look forward to seeing the results of the analyses performed by your own lab. If you have any questions regarding these data, give me a call at (201) 236-2118.

Sincerely,

Bill Stansley

William Stansley
Wildlife Toxicologist

Method

Subsamples of liver weighing approximately 2 grams were dissected from the liver samples using stainless steel implements. Surface tissue was removed in order to minimize the possibility of contamination. The samples were weighed, dried overnight at 103°C, cooled in a dessicator and reweighed. The dried samples were charred for 1 hour and ashed at 475° C for 24 hours. The ash was dissolved by heating on a hot plate with 2 mL of Ultrex nitric acid and 20 mL distilled water and diluted to a final volume of 500 mL. The digests were analyzed using a Perkin Elmer Model 2380 AA equipped with an HGA 400 graphite furnace. Aliquots of the digested samples were injected into a stabilized temperature platform furnace along with a matrix modifier containing of 0.2 mg/10 uL $(NH_4)_2 HPO_4$.

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Environmental Trace Substances Research Center

Route 3
Columbia, Missouri 65203
Telephone (314) 882-2151

September 21, 1989

Gregory Smith
U.S. Department of the Interior
Patuxent Wildlife Research Center
Laurel, Maryland 20708

Dear Dr. Smith:

Enclosed are data, quality control reports, procedures and invoice for Cat. 5814, P.O. #85800-89-30058, Region I.D. #89-5-100.

Let me know if you have any questions.

Sincerely,

Edward J. Hinderberger

Edward J. Hinderberger, Jr.
Group Leader

EJH:ske

Enclosures

received
9/26/89

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% MOISTURE

For animal tissue and sediments of sufficient size, moisture was determined by placing a weighed aliquot of the sample in a Fisher Isotemp oven and drying at 103-105°C. The dried sample was then weighed and the data entered into a computer program to generate the % moisture and final report.

Plants, and samples too small for oven dried moisture determination had the % moisture calculated from the moisture lost during the freeze-drying in the Labcono Freeze-Dryer 8. The data was entered into a computer program to generate a % moisture and final report.

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HOMOGENIZATION

Large tissue samples, such as whole fish, were first run through a meat grinder one or more times depending on the size of the sample. An aliquot of the ground sample was weighed and frozen. For smaller tissue samples and plant samples the entire sample was weighed and then frozen. For sediments, the sample was mixed and an aliquot weighed and frozen. The frozen samples were placed in a Labcono Freeze Dryer 8 until the moisture had been removed. The dry samples were then weighed and further homogenized using a blender, or Spex Industries, Inc. Model 8000 mixer/mill with tungsten-carbide vial and balls.

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NITRIC - PERCHOLORIC DIGESTION - (ICP)

Approximately 0.5 g. of sample was weighed into a freshly cleaned 100 ml. quartz Kjeldahl flask. (Sediment samples and samples containing a high percent of silica were digested in 100 ml. teflon beakers.) For water samples, 50 ml. of sample were measured into a teflon beaker. Slowly 15 ml. of concentrated sub-boiled HNO_3 and 2.5 ml. of concentrated sub-boiled $HClO_4$ were added. Foaming may occur with some samples. If the foaming started to become excessive, the container was cooled in a beaker of cold water. After the initial reaction had subsided, the sample was placed on low heat until the evolution of dark red fumes had ceased. Gradually, the heat was increased until the HNO_3 began refluxing, samples were allowed to reflux overnight. (This decreased the chance for charring during the reaction with $HClO_4$.) After the refluxing, the heat was gradually increased until the HNO_3 had been driven off, and the reaction with $HClO_4$ had occured. When dense white fumes from the $HClO_4$ were evident, the samples were removed from the heat and allowed to cool. Two ml. of concentrated sub-boiled HCl were added. The flasks were replaced on the heat and warmed until the containers were hot to the touch or started to boil. They were removed from the heat, and 5-10 ml. of deionized water were added. Samples were allowed to cool. They were then diluted using deionized water in a 50 ml. volumetric flask and transferred to clean, labeled, 2 oz. polyethylene bottles.

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NITRIC REFLUX DIGESTION FOR MERCURY

Approximately 0.5 g. of sample was weighed into a freshly cleaned 50 ml. round bottom flask with 24/40 ground glass neck. For waters, 10 ml. of sample were measured into the flask. Five ml. of concentrated sub-boiled HNO_3 were added and the flask was placed under a 12 inch water-cooled condenser with water running through the condenser. The heat was turned up to allow the HNO_3 to reflux no more than 1/3 the height of the columns. Samples were allowed to reflux for two hours. Then the heat was turned off and the samples allowed to cool. The condensers were rinsed with 1% v/v HCl and the flasks removed. The samples were diluted with 1% v/v HCl in a 50 ml. volumetric flask and then transferred to clean, labeled, 2 oz. flint glass bottles.

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PRECONCENTRATION OF ICP - PH 6

A 30 g. sample of the digestate for I.C.P. was weighed into a 50 ml. screw top centrifuge tube. One ml. of 2000 ppm Indium and 1 ml. of 10% ammonium acetate buffer were added and the pH adjusted to 6.5 with high purity NH_4OH from Seastar. One ml. of a 10% DDTC was added and the caps screwed on and mixed by turning end over end 6 times slowly. After mixing, the tubes were centrifuged in an I.E.C. refrigerated centrifuge at 20°C for 15 minutes at 15,000 RPM. The liquid was then decanted from the precipitate and 0.3 ml. of high purity HNO_3 from Seastar was added. The Tubes were heated in a water bath at 95°C to dissolve the precipitate and diluted to 3 ml. with deionized water.

For samples high in Calcium and Phosphate a pH of 6.0 was used to reduce the precipitation of $Ca_3(PO_4)_2$.

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MERCURY - COLD VAPOR ATOMIC ABSORPTION

Equipment used for Cold Vapor Atomic Absorption include: Perkin-Elmer Model 403 AA; Perkin-Elmer Model 056 recorder; Technicon Sampler I; Technicon Pump II; a glass cell with quartz windows and capillary tube for entry and exit of the mercury vapor; and a liquid-gas separator. The samples were placed in 4 ml. sample cups at least 3/4 full. The samples were mixed with hydroxylamine for preliminary reduction, then stannous chloride for reduction to the mercury vapor. The vapor was separated from the liquid and passed through the cell mounted in the light path of the burner compartment. The peaks were recorded and the peak heights measured. The standardization was done with at least 5 standards in the range of 0 to 10 ppb. The correlation coefficient was usually 0.9999 or better and must have been at least 0.999 to have been acceptable. A standard was run every 8-10 samples to check for drift in the standardization. This was usually less than 5%. Standards were preserved with 10% v/v HNO_3, 1% v/v HCl and 0.05% w/v $K_2Cr_2O_7$. The solution concentrations were calculated and the data entered into the AA calculation program which corrected for blank, dilution, sample weight, sample volume and entered the data into the LIMS system for report generation.

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Telephone (314) 882-2151

INDUCTIVELY COUPLED PLASMA (ICP)

The instrument used for ICP analysis was a Jarrell-Ash Model 1100 Mark III with 40 analytical channels, controlled by a Digital Equipment Company (DEC) 11/23+ computer with two RL02 disk drives, DEC VT100 terminal, and DEC LA120 decwriter III. The instrument was standardized with a series of seven standards containing 36 elements. After the standardization, the detection limit was determined by taking ten integrations of the zero standard; three times the standard deviation of the mean was used as the detection limit. Instrumental quality control samples were then analyzed to check the ICP operation. If the values were acceptable, the samples were then analyzed. Standards were run every 10-15 samples to check for drift. If the drift was more than 5%, the instrument was restandardized. After the analyses were completed, the data were transferred to the Perkin-Elmer LIMS 2000 computer for calculation. The final detection limit for each element was further increased by 4% of the magnitude of the spectral interferences from the other elements. The data were checked before calculation to correct for possible errors in sample number, weight, volumes and dilution. The data were calculated using the ICP calculation program written by ETSRC computer staff, which corrected for blanks, standard drift, spectral interferences, sample weight, sample volume, and dilution. After the quality control was reviewed, a final report was generated using a Hewlett-Packard laser jet printer.

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GERG
Geochemical and Environmental Research Group
Ten South Graham Road
College Station, Texas 77840

TEXAS A&M UNIVERSITY
Telephone: (409) 690-0095
FAX: (409) 690-0059
TELEX: 910-380-8722

11 October, 1989

Dr. Greg Smith
Patuxent Analytical Control Facility
U.S. Fish and Wildlife Service
Patuxent Wildlife Research Center
Laurel, MD 20708

Dear Greg:

Enclosed are the results of the analyses of samples in Catalog 5814 and a brief discription of the methods used. The reporting limits are higher for the fat samples because of the lower sample weights.

Sincerely,

Terry L. Wade

Terry L. Wade, Ph.D.
Associate Research Scientist
Geochemical and Environmental
Research Group (GERG)

cc: J. Brooks
Texas A&M Research Foundation

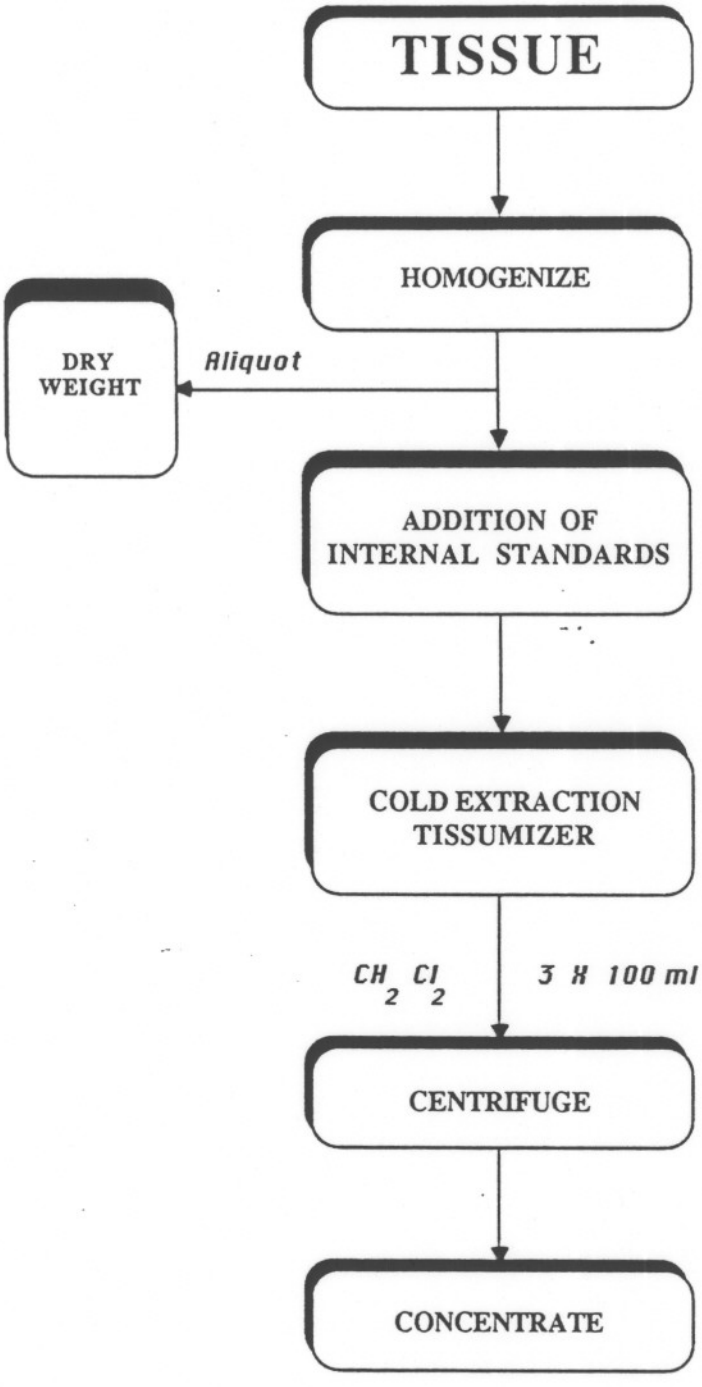
The tissue samples were extracted by the NOAA Status and Trends Method (MacLeod *et al.* 1985) with minor revisions (Brooks *et al.*, 1988; Wade *et al.*, 1988). A flow diagram of the procedure is attached. Briefly, the tissue samples were homogenized with a Teckmar Tissumizer. A 1-gram sample (wet weight) was extracted with the Teckmar Tissumizer by adding internal standards, Na_2SO_4, and methylene chloride in a centrifuge tube. The tissue extracts were purified by silica/alumina column chromatography to isolate the aliphatic and PAH/pesticide/PCB fractions. The fraction containing the PAH/pesticides/PCB fractionation was further purified by Sephadex chromatography in order to remove interfering lipids. The quantitative analyses were performed by capillary gas chromatography (CGC) with a flame ionization detector for aliphatic hydrocarbons, CGC with electron capture detector for pesticides and PCB's, and a mass spectrometer detector in the SIM mode for aromatic hydrocarbons (Wade *et al.*, 1988).

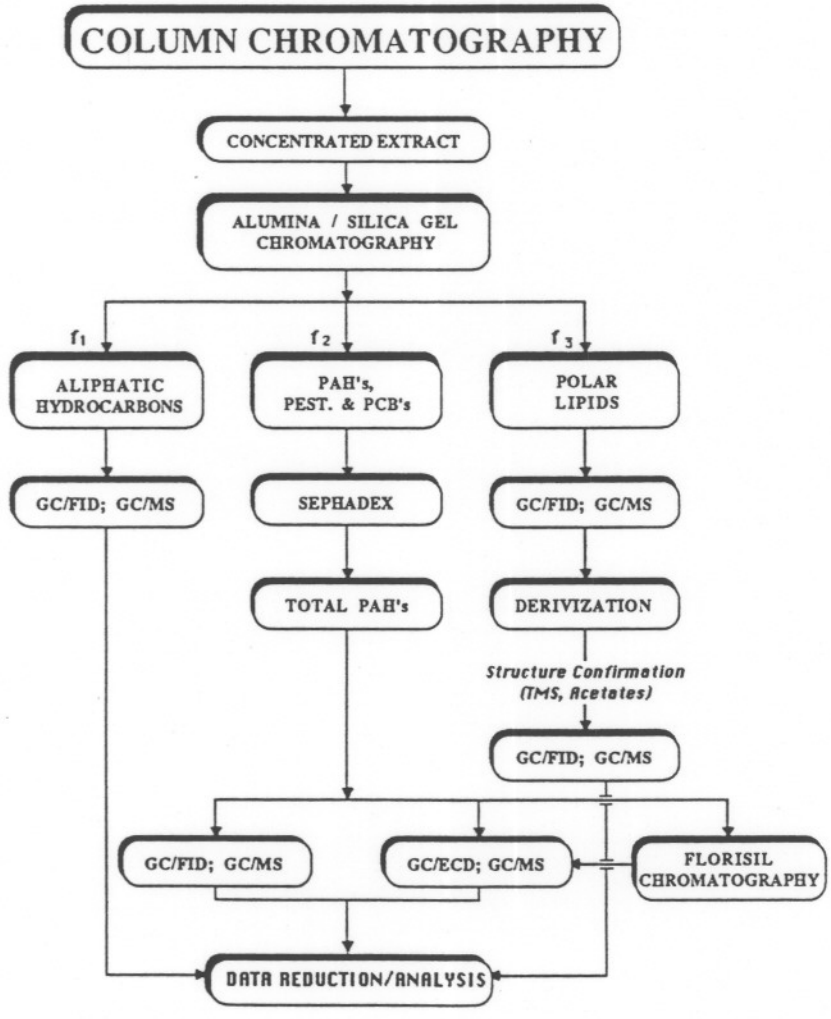
References

Brooks, J.M., Wade, T.L., Atlas, E.L., Kennicutt II, M.C., Presley, B.J., Fay, R.R., Powell, E.N. and Wolff, G., (1987c). Analysis of bivalves and sediments for organic chemicals and trace elements. Annual Report for NOAA's National Status and Trends Program, Contract 50-DGNC-5-00262.

MacLeod, W.D., Brown, D.W., Friedman, A.J., Burrow, D.G., Mayes, O., Pearce, R.W., Wigren, C.A. and Bogar, R.G. (1985). Standard Analytical Procedures of the NOAA National Analytical Facility 1985-1986. Extractable Toxic Organic Compounds, 2nd Ed. U.S. Department of Commerce, NOAA/NMFS. NOAA Tech. Memo. NMFS F/NWC-92.

Wade, T.L., Atlas,E.L., Brooks, J.M., Kennicutt, M.C. II, Fox, R.G., Sericano, J., Garcia, B. and DeFreitas, D. (1988). NOAA Gulf of Mexico Status and Trends Program: Trace organic contaminant distribution in sediments and oysters. *Estuaries*, *11*, 171-179.


TISSUE
HOMOGENIZE
DRY WEIGHT
Aliquot
ADDITION OF INTERNAL STANDARDS
COLD EXTRACTION TISSUMIZER
CH_2Cl_2
3 X 100 ml
CENTRIFUGE
CONCENTRATE


COLUMN CHROMATOGRAPHY
CONCENTRATED EXTRACT
ALUMINA / SILICA GEL CHROMATOGRAPHY
f1
f2
f3
ALIPHATIC HYDROCARBONS
PAH's, PEST. & PCB's
POLAR LIPIDS
GC/FID; GC/MS
SEPHADEX
GC/FID; GC/MS
TOTAL PAH's
DERIVIZATION
Structure Confirmation (TMS, Acetates)
GC/FID; GC/MS
GC/FID; GC/MS
GC/ECD; GC/MS
FLORISIL CHROMATOGRAPHY
DATA REDUCTION/ANALYSIS

RAW DATA

(B-1)

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Let's protect our earth

State of New Jersey

DEPARTMENT OF ENVIRONMENTAL PROTECTION

DIVISION OF
FISH, GAME AND WILDLIFE
GEORGE P. HOWARD
DIRECTOR

PLEASE REPLY TO:
CN 400
TRENTON, NEW JERSEY 08625

Freshwater Fisheries Laboratory
PO Box 394
Lebanon, NJ 08833

August 18, 1989

Michael Chezik
US Fish and Wildlife Service
PO Box 534
705 White Horse Pike
Absecon, NJ 08201

Dear Mike:

Enclosed are the results of the Cd analyses we performed on the 32 deer liver samples that were submitted to our lab in March 1989. I have also included a description of the analytical method and the results of QA/QC analyses that were performed.

We look forward to seeing the results of the analyses performed by your own lab. If you have any questions regarding these data, give me a call at (201) 236-2118.

Sincerely,

William Stansley
Wildlife Toxicologist

LIVER Cd CONCENTRATIONS (ug/g)

SAMPLE NUMBER	AGE (YEARS)	FIELD WEIGHT (LBS)	SEX	Cd CONC. DRY WEIGHT	Cd CONC. FRESH WEIGHT
LI24	0.5	42	M	0.41	0.13
LI19	2.5	88	F	1.41	0.37
LI12	1.5	80	M	1.30	0.43
LI17	1.5	74	M	1.19	0.37
LI27	1.5	90	F	1.20	0.35
LI25	2.5	82	F	2.81	0.84
LI29	0.5	41	F	0.78	0.24
LI16	0.5	52	M	1.10	0.30
LI06	0.5	52	F	0.43	0.12
LI09	4.5+	88	F	2.38	0.62
LI04	0.5	40	F	1.27	0.40
LI07	1.5	74	M	1.82	0.58
LI14	1.5	62	F	2.16	0.73
LI22	3.5	107	F	1.08	0.32
LI28	2.5	122	M	0.68	0.21
LI31	1.5	114	M	1.26	0.35
LI32	1.5	102	M	0.47	0.14
LI26	1.5	62	F	1.11	0.33
LI11	0.5	52	M	0.16	0.05
LI05	0.5	42	M	1.16	0.36
LI30	0.5	54	F	0.83	0.26
LI13	3.5	93	F	0.99	0.29
LI18	0.5	53	F	0.32	0.10
LI20	1.5	78	F	2.33	0.74
LI23	2.5	105	M	2.46	0.78
LI02	1.5	82	M	1.57	0.47
LI03	2.5	88	F	1.67	0.53
LI01	0.5	35	M	0.53	0.16
LI08	1.5	85	M	1.61	0.47
LI10	3.5	93	F	2.55	0.87
LI15	0.5	58	M	1.24	0.39
LI21	0.5	60	M	0.62	0.19

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UNIVERSITY OF MISSOURI

Environmental Trace Substances Research Center

Route 3
Columbia, Missouri 65203
Telephone (314) 882-2151

September 21, 1989

Gregory Smith
U.S. Department of the Interior
Patuxent Wildlife Research Center
Laurel, Maryland 20708

Dear Dr. Smith:

Enclosed are data, quality control reports, procedures and invoice for Cat. 5814, P.O. #85800-89-30058, Region I.D. #89-5-100.

Let me know if you have any questions.

Sincerely,

Edward J. Hinderberger

Edward J. Hinderberger, Jr.
Group Leader

EJH:ske

Enclosures

53.

Environmental Trace Substances Research Center
ICP Scan - Sample Analysis Report

Project: USDI - Cat. 5814 Units: MCG/G DRY WEIGHT
P.O.: 85800-89-30058 Batch #: B-89030466

Customer ID: R5ABLI 02
Description: DEER LIVER TISSUE
ETSRC ID: 9030468

Elm	Result	Estimated Sample Detection Limit
AL	0.7	0.4
BE	<0.01	0.01
CD	2.2	0.05
CR	0.98	0.1
CU	128.	0.02
FE	333.	0.1
MN	11.3	0.03
NI	0.5	0.4
PB	<0.5	0.5
TL	<0.5	0.5
ZN	110.	0.09

Customer ID: R5ABLI 03
Description: DEER LIVER TISSUE
ETSRC ID: 9030469

Elm	Result	Estimated Sample Detection Limit
AL	0.9	0.4
BE	<0.01	0.01
CD	1.6	0.06
CR	0.2	0.1
CU	239.	0.02
FE	377.	0.1
MN	11.1	0.03
NI	<0.4	0.4
PB	<0.5	0.5
TL	<0.5	0.5
ZN	116.	0.1

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Environmental Trace Substances Research Center
ICP Scan - Sample Analysis Report

Project: USDI - Cat. 5814 Units: MCG/G DRY WEIGHT
P.O.: 85800-89-30058 Batch #: B-89030466

Customer ID: R5ABLI 04
Description: DEER LIVER TISSUE
ETSRC ID: 9030470

Elm	Result	Estimated Sample Detection Limit
AL	0.8	0.4
BE	<0.01	0.01
CD	1.5	0.05
CR	0.3	0.1
CU	112.	0.02
FE	231.	0.1
MN	12.5	0.03
NI	<0.4	0.4
PB	<0.5	0.5
TL	<0.5	0.5
ZN	113.	0.08

Customer ID: R5ABLI 06
Description: DEER LIVER TISSUE
ETSRC ID: 9030471

Elm	Result	Estimated Sample Detection Limit
AL	1.2	0.4
BE	<0.01	0.01
CD	0.42	0.04
CR	0.68	0.1
CU	15.8	0.02
FE	187.	0.1
MN	14.3	0.03
NI	<0.4	0.4
PB	<0.5	0.5
TL	<0.5	0.5
ZN	97.9	0.03

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Environmental Trace Substances Research Center
ICP Scan - Sample Analysis Report

Project: USDI - Cat. 5814 Units: MCG/G DRY WEIGHT
P.O.: 85800-89-30058 Batch #: B-89030466

Customer ID: R5ABLI 07
Description: DEER LIVER TISSUE
ETSRC ID: 9030472

Elm	Result	Estimated Sample Detection Limit
AL	1.	0.4
BE	<0.01	0.01
CD	1.8	0.06
CR	3.0	0.1
CU	202.	0.02
FE	367.	0.1
MN	11.0	0.03
NI	1.8	0.4
PB	<0.5	0.5
TL	<0.5	0.5
ZN	117.	0.1

Customer ID: R5ABLI 08
Description: DEER LIVER TISSUE
ETSRC ID: 9030473

Elm	Result	Estimated Sample Detection Limit
AL	2.2	0.4
BE	<0.01	0.01
CD	1.7	0.06
CR	0.51	0.1
CU	161.	0.02
FE	482.	0.1
MN	8.93	0.03
NI	<0.4	0.4
PB	<0.5	0.5
TL	<0.5	0.5
ZN	138.	0.1

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Environmental Trace Substances Research Center
ICP Scan - Sample Analysis Report

Project: USDI - Cat. 5814 Units: MCG/G DRY WEIGHT
P.O.: 85800-89-30058 Batch #: B-89030466

Customer ID: R5ABLI 09
Description: DEER LIVER TISSUE
ETSRC ID: 9030474

Elm	Result	Estimated Sample Detection Limit
AL	2.1	0.4
BE	<0.01	0.01
CD	2.7	0.08
CR	0.1	0.1
CU	367.	0.02
FE	322.	0.1
MN	12.1	0.03
NI	<0.4	0.4
PB	<0.5	0.5
TL	<0.5	0.5
ZN	108.	0.2

Customer ID: R5ABLI 10
Description: DEER LIVER TISSUE
ETSRC ID: 9030475

Elm	Result	Estimated Sample Detection Limit
AL	2.0	0.4
BE	<0.01	0.01
CD	2.7	0.07
CR	0.98	0.1
CU	259.	0.02
FE	418.	0.1
MN	10.9	0.03
NI	0.6	0.4
PB	<0.5	0.5
TL	<0.5	0.5
ZN	106.	0.2

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Environmental Trace Substances Research Center
ICP Scan - Sample Analysis Report

Project: USDI - Cat. 5814 Units: MCG/G DRY WEIGHT
P.O.: 85800-89-30058 Batch #: B-89030466

Customer ID: R5ABLI 11
Description: DEER LIVER TISSUE
ETSRC ID: 9030476

Elm	Result	Estimated Sample Detection Limit
AL	0.6	0.4
BE	<0.01	0.01
CD	0.22	0.04
CR	1.1	0.1
CU	20.9	0.02
FE	338.	0.1
MN	12.2	0.03
NI	0.6	0.4
PB	<0.5	0.5
TL	<0.5	0.5
ZN	125.	0.04

Customer ID: R5ABLI 12
Description: DEER LIVER TISSUE
ETSRC ID: 9030477

Elm	Result	Estimated Sample Detection Limit
AL	1.2	0.4
BE	<0.01	0.01
CD	1.2	0.07
CR	2.0	0.1
CU	307.	0.02
FE	316.	0.1
MN	14.5	0.03
NI	1.4	0.4
PB	<0.5	0.5
TL	<0.5	0.5
ZN	112.	0.2

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Environmental Trace Substances Research Center
ICP Scan - Sample Analysis Report

Project: USDI - Cat. 5814 Units: MCG/G DRY WEIGHT
P.O.: 85800-89-30058 Batch #: B-89030466

Customer ID: R5ABLI 13
Description: DEER LIVER TISSUE
ETSRC ID: 9030478

Elm	Result	Estimated Sample Detection Limit
AL	0.7	0.4
BE	<0.01	0.01
CD	0.92	0.04
CR	0.2	0.1
CU	14.4	0.02
FE	571.	0.1
MN	8.48	0.03
NI	<0.4	0.4
PB	<0.5	0.5
TL	<0.5	0.5
ZN	93.4	0.04

Customer ID: R5ABLI 14
Description: DEER LIVER TISSUE
ETSRC ID: 9030479

Elm	Result	Estimated Sample Detection Limit
AL	0.9	0.4
BE	<0.01	0.01
CD	2.1	0.07
CR	0.66	0.1
CU	263.	0.02
FE	287.	0.1
MN	17.5	0.03
NI	<0.5	0.5
PB	<0.5	0.5
TL	<0.5	0.5
ZN	109.	0.2

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Environmental Trace Substances Research Center
ICP Scan - Sample Analysis Report

Project: USDI - Cat. 5814 Units: MCG/G DRY WEIGHT
P.O.: 85800-89-30058 Batch #: B-89030466

Customer ID: R5ABLI 15
Description: DEER LIVER TISSUE
ETSRC ID: 9030480

Elm	Result	Estimated Sample Detection Limit
AL	0.6	0.4
BE	<0.01	0.01
CD	1.2	0.05
CR	0.2	0.1
CU	117.	0.02
FE	263.	0.1
MN	11.9	0.03
NI	0.4	0.4
PB	<0.5	0.5
TL	<0.5	0.5
ZN	108.	0.08

Customer ID: R5ABLI 16
Description: DEER LIVER TISSUE
ETSRC ID: 9030481

Elm	Result	Estimated Sample Detection Limit
AL	<0.4	0.4
BE	<0.01	0.01
CD	1.1	0.05
CR	0.2	0.1
CU	91.7	0.02
FE	357.	0.1
MN	16.0	0.03
NI	<0.4	0.4
PB	<0.5	0.5
TL	<0.5	0.5
ZN	115.	0.07

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Environmental Trace Substances Research Center
ICP Scan - Sample Analysis Report

Project: USDI - Cat. 5814 Units: MCG/G DRY WEIGHT
P.O.: 85800-89-30058 Batch #: B-89030466

Customer ID: R5ABLI 17
Description: DEER LIVER TISSUE
ETSRC ID: 9030482

Elm	Result	Estimated Sample Detection Limit
AL	0.5	0.4
BE	<0.01	0.01
CD	1.1	0.05
CR	0.42	0.1
CU	78.4	0.02
FE	346.	0.1
MN	10.1	0.03
NI	<0.4	0.4
PB	<0.5	0.5
TL	<0.5	0.5
ZN	80.5	0.07

Customer ID: R5ABLI 18
Description: DEER LIVER TISSUE
ETSRC ID: 9030483

Elm	Result	Estimated Sample Detection Limit
AL	0.4	0.4
BE	<0.01	0.01
CD	0.36	0.06
CR	0.53	0.1
CU	148.	0.02
FE	265.	0.1
MN	12.7	0.03
NI	0.5	0.4
PB	<0.5	0.5
TL	<0.5	0.5
ZN	116.	0.1

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Environmental Trace Substances Research Center
ICP Scan - Sample Analysis Report

Project: USDI - Cat. 5814 Units: MCG/G DRY WEIGHT
P.O.: 85800-89-30058 Batch #: B-89030466

Customer ID: R5ABLI 19
Description: DEER LIVER TISSUE
ETSRC ID: 9030484

Elm	Result	Estimated Sample Detection Limit
AL	1.4	0.4
BE	<0.01	0.01
CD	1.6	0.08
CR	0.41	0.1
CU	363.	0.02
FE	228.	0.1
MN	12.7	0.03
NI	<0.4	0.4
PB	<0.5	0.5
TL	<0.5	0.5
ZN	129.	0.2

Customer ID: R5ABLI 20
Description: DEER LIVER TISSUE
ETSRC ID: 9030485

Elm	Result	Estimated Sample Detection Limit
AL	0.6	0.4
BE	<0.01	0.01
CD	2.4	0.04
CR	0.3	0.1
CU	8.47	0.02
FE	346.	0.1
MN	11.3	0.03
NI	<0.4	0.4
PB	<0.5	0.5
TL	<0.5	0.5
ZN	100.	0.03

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Environmental Trace Substances Research Center
ICP Scan - Sample Analysis Report

Project: USDI - Cat. 5814 Units: MCG/G DRY WEIGHT
P.O.: 85800-89-30058 Batch #: B-89030466

Customer ID: R5ABLI 21
Description: DEER LIVER TISSUE
ETSRC ID: 9030486

Elm	Result	Estimated Sample Detection Limit
AL	0.6	0.4
BE	<0.01	0.01
CD	0.68	0.05
CR	0.75	0.1
CU	59.1	0.02
FE	361.	0.1
MN	13.4	0.03
NI	0.5	0.4
PB	<0.5	0.5
TL	<0.5	0.5
ZN	142.	0.06

Customer ID: R5ABLI 22
Description: DEER LIVER TISSUE
ETSRC ID: 9030490

Elm	Result	Estimated Sample Detection Limit
AL	2.1	0.4
BE	<0.01	0.01
CD	1.1	0.06
CR	0.85	0.1
CU	167.	0.02
FE	279.	0.1
MN	12.3	0.03
NI	0.5	0.5
PB	<0.5	0.5
TL	<0.5	0.5
ZN	91.9	0.1

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Environmental Trace Substances Research Center
ICP Scan - Sample Analysis Report

Project: USDI - Cat. 5814 Units: MCG/G DRY WEIGHT
P.O.: 85800-89-30058 Batch #: B-89030466

Customer ID: R5ABLI 23
Description: DEER LIVER TISSUE
ETSRC ID: 9030491

Elm	Result	Estimated Sample Detection Limit
AL	1.	0.4
BE	<0.01	0.01
CD	1.1	0.05
CR	0.55	0.1
CU	121.	0.02
FE	332.	0.1
MN	8.75	0.03
NI	<0.4	0.4
PB	<0.5	0.5
TL	<0.5	0.5
ZN	73.0	0.09

Customer ID: R5ABLI 24
Description: DEER LIVER TISSUE
ETSRC ID: 9030492

Elm	Result	Estimated Sample Detection Limit
AL	1.2	0.4
BE	<0.01	0.01
CD	0.41	0.05
CR	1.1	0.1
CU	50.6	0.02
FE	365.	0.1
MN	11.4	0.03
NI	0.7	0.4
PB	<0.5	0.5
TL	<0.5	0.5
ZN	121.	0.05

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Environmental Trace Substances Research Center
ICP Scan - Sample Analysis Report

Project: USDI - Cat. 5814 Units: MCG/G DRY WEIGHT
P.O.: 85800-89-30058 Batch #: B-89030466

Customer ID: R5ABLI 25
Description: DEER LIVER TISSUE
ETSRC ID: 9030493

Elm	Result	Estimated Sample Detection Limit
AL	0.6	0.4
BE	<0.01	0.01
CD	2.9	0.06
CR	0.3	0.1
CU	173.	0.02
FE	360.	0.1
MN	12.8	0.03
NI	<0.4	0.4
PB	<0.5	0.5
TL	<0.5	0.5
ZN	116.	0.1

Customer ID: R5ABLI 26
Description: DEER LIVER TISSUE
ETSRC ID: 9030494

Elm	Result	Estimated Sample Detection Limit
AL	1.0	0.4
BE	<0.01	0.01
CD	1.2	0.06
CR	0.41	0.1
CU	173.	0.02
FE	405.	0.1
MN	8.73	0.03
NI	<0.4	0.4
PB	<0.5	0.5
TL	<0.5	0.5
ZN	93.4	0.1

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Environmental Trace Substances Research Center
ICP Scan - Sample Analysis Report

Project: USDI - Cat. 5814 Units: MCG/G DRY WEIGHT
P.O.: 85800-89-30058 Batch #: B-89030466

Customer ID: R5ABLI 27
Description: DEER LIVER TISSUE
ETSRC ID: 9030495

Elm	Result	Estimated Sample Detection Limit
AL	0.5	0.4
BE	<0.01	0.01
CD	1.3	0.05
CR	0.1	0.1
CU	86.4	0.02
FE	261.	0.1
MN	9.89	0.03
NI	<0.4	0.4
PB	<0.5	0.5
TL	<0.5	0.5
ZN	128.	0.07

Customer ID: R5ABLI 28
Description: DEER LIVER TISSUE
ETSRC ID: 9030496

Elm	Result	Estimated Sample Detection Limit
AL	1.5	0.4
BE	<0.01	0.01
CD	1.0	0.07
CR	<0.1	0.1
CU	314.	0.02
FE	417.	0.1
MN	11.9	0.03
NI	<0.4	0.4
PB	0.6	0.5
TL	<0.5	0.5
ZN	131.	0.2

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Environmental Trace Substances Research Center
ICP Scan - Sample Analysis Report

Project: USDI - Cat. 5814 Units: MCG/G DRY WEIGHT
P.O.: 85800-89-30058 Batch #: B-89030466

Customer ID: R5ABLI 29
Description: DEER LIVER TISSUE
ETSRC ID: 9030497

Elm	Result	Estimated Sample Detection Limit
AL	0.6	0.4
BE	<0.01	0.01
CD	0.65	0.04
CR	0.65	0.1
CU	13.2	0.02
FE	646.	0.1
MN	10.2	0.03
NI	0.4	0.4
PB	<0.5	0.5
TL	<0.5	0.5
ZN	115.	0.04

Customer ID: R5ABLI 30
Description: DEER LIVER TISSUE
ETSRC ID: 9030498

Elm	Result	Estimated Sample Detection Limit
AL	0.7	0.4
BE	<0.01	0.01
CD	0.98	0.07
CR	0.2	0.1
CU	221.	0.02
FE	665.	0.1
MN	13.7	0.04
NI	<0.5	0.5
PB	<0.5	0.5
TL	<0.5	0.5
ZN	165.	0.1

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Environmental Trace Substances Research Center
ICP Scan - Sample Analysis Report

Project: USDI - Cat. 5814 Units: MCG/G DRY WEIGHT
P.O.: 85800-89-30058 Batch #: B-89030466

Customer ID: R5ABLI 31
Description: DEER LIVER TISSUE
ETSRC ID: 9030499

Elm	Result	Estimated Sample Detection Limit
AL	0.7	0.4
BE	<0.01	0.01
CD	1.4	0.08
CR	0.62	0.1
CU	348.	0.02
FE	287.	0.1
MN	13.8	0.03
NI	0.7	0.4
PB	<0.5	0.5
TL	<0.5	0.5
ZN	147.	0.2

Customer ID: R5ABLI 32
Description: DEER LIVER TISSUE
ETSRC ID: 9030500

Elm	Result	Estimated Sample Detection Limit
AL	0.9	0.4
BE	<0.01	0.01
CD	0.70	0.05
CR	1.4	0.1
CU	84.8	0.02
FE	261.	0.1
MN	15.8	0.03
NI	1.	0.4
PB	<0.5	0.5
TL	<0.5	0.5
ZN	114.	0.07

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Environmental Trace Substances Research Center
ICP Scan - Sample Analysis Report

Project: USDI - Cat. 5814 Units: MCG/G DRY WEIGHT
P.O.: 85800-89-30058 Batch #: B-89030466

Customer ID: R5ABMI 07
Description: DEER MUSCLE TISSUE
ETSRC ID: 9030504

Elm	Result	Estimated Sample Detection Limit
AL	4.1	0.4
BE	<0.01	0.01
CD	<0.04	0.04
CR	2.1	0.1
CU	5.73	0.02
FE	138.	0.1
MN	0.83	0.03
NI	1.	0.4
PB	<0.5	0.5
TL	<0.4	0.4
ZN	86.7	0.03

Customer ID: R5ABMI 09
Description: DEER MUSCLE TISSUE
ETSRC ID: 9030505

Elm	Result	Estimated Sample Detection Limit
AL	3.0	0.4
BE	<0.01	0.01
CD	0.05	0.04
CR	5.2	0.1
CU	6.67	0.02
FE	143.	0.1
MN	1.4	0.03
NI	3.0	0.4
PB	<0.5	0.5
TL	<0.5	0.5
ZN	68.6	0.03

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Environmental Trace Substances Research Center
ICP Scan - Sample Analysis Report

Project: USDI - Cat. 5814 Units: MCG/G DRY WEIGHT
P.O.: 85800-89-30058 Batch #: B-89030466

Customer ID: R5ABMI 11
Description: DEER MUSCLE TISSUE
ETSRC ID: 9030507

Elm	Result	Estimated Sample Detection Limit
AL	0.6	0.4
BE	<0.01	0.01
CD	<0.04	0.04
CR	0.37	0.1
CU	8.32	0.02
FE	75.7	0.1
MN	0.66	0.03
NI	0.5	0.4
PB	<0.5	0.5
TL	<0.4	0.4
ZN	42.2	0.03

Customer ID: R5ABMI 12
Description: DEER MUSCLE TISSUE
ETSRC ID: 9030508

Elm	Result	Estimated Sample Detection Limit
AL	<0.4	0.4
BE	<0.01	0.01
CD	<0.04	0.04
CR	0.3	0.1
CU	5.85	0.02
FE	98.0	0.1
MN	0.71	0.03
NI	<0.4	0.4
PB	<0.5	0.5
TL	<0.4	0.4
ZN	62.5	0.03

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Environmental Trace Substances Research Center
ICP Scan - Sample Analysis Report

Project: USDI - Cat. 5814 Units: MCG/G DRY WEIGHT
P.O.: 85800-89-30058 Batch #: B-89030466

Customer ID: R5ABMI 18
Description: DEER MUSCLE TISSUE
ETSRC ID: 9030509

Elm	Result	Estimated Sample Detection Limit
AL	0.6	0.4
BE	<0.01	0.01
CD	<0.04	0.04
CR	0.58	0.1
CU	6.98	0.02
FE	89.7	0.1
MN	0.73	0.03
NI	<0.4	0.4
PB	<0.5	0.5
TL	<0.5	0.5
ZN	44.8	0.03

Customer ID: R5ABMI 19
Description: DEER MUSCLE TISSUE
ETSRC ID: 9030510

Elm	Result	Estimated Sample Detection Limit
AL	0.7	0.4
BE	<0.01	0.01
CD	<0.04	0.04
CR	0.38	0.1
CU	5.51	0.02
FE	101.	0.1
MN	0.50	0.03
NI	<0.4	0.4
PB	<0.5	0.5
TL	<0.5	0.5
ZN	130.	0.03

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Environmental Trace Substances Research Center
ICP Scan - Sample Analysis Report

Project: USDI - Cat. 5814 Units: MCG/G DRY WEIGHT
P.O.: 85800-89-30058 Batch #: B-89030466

Customer ID: R5ABMI 20
Description: DEER MUSCLE TISSUE
ETSRC ID: 9030511

Elm	Result	Estimated Sample Detection Limit
AL	<0.4	0.4
BE	<0.01	0.01
CD	0.04	0.04
CR	0.3	0.1
CU	5.64	0.02
FE	118.	0.1
MN	0.74	0.03
NI	<0.4	0.4
PB	<0.5	0.5
TL	<0.5	0.5
ZN	56.5	0.03

Customer ID: R5ABMI 21
Description: DEER MUSCLE TISSUE
ETSRC ID: 9030512

Elm	Result	Estimated Sample Detection Limit
AL	0.5	0.4
BE	<0.01	0.01
CD	<0.04	0.04
CR	0.54	0.1
CU	5.69	0.02
FE	82.2	0.1
MN	0.65	0.03
NI	<0.4	0.4
PB	<0.5	0.5
TL	<0.5	0.5
ZN	93.8	0.03

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Environmental Trace Substances Research Center
ICP Scan - Sample Analysis Report

Project: USDI - Cat. 5814 Units: MCG/G DRY WEIGHT
P.O.: 85800-89-30058 Batch #: B-89030466

Customer ID: R5ABMI 22
Description: DEER MUSCLE TISSUE
ETSRC ID: 9030513

Elm	Result	Estimated Sample Detection Limit
AL	16.	0.4
BE	<0.01	0.01
CD	0.05	0.04
CR	0.65	0.1
CU	6.42	0.02
FE	139.	0.1
MN	1.4	0.03
NI	<0.4	0.4
PB	<0.5	0.5
TL	<0.4	0.4
ZN	142.	0.03

Customer ID: R5ABMI 32
Description: DEER MUSCLE TISSUE
ETSRC ID: 9030514

Elm	Result	Estimated Sample Detection Limit
AL	0.5	0.4
BE	<0.01	0.01
CD	0.05	0.04
CR	0.51	0.1
CU	6.61	0.02
FE	124.	0.1
MN	0.75	0.03
NI	<0.5	0.5
PB	<0.5	0.5
TL	<0.5	0.5
ZN	85.9	0.03

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Quality Control Report
Environmental Trace Substances Research Center
ICP Scan - Duplicate Report

Project: USDI - Cat. 5814 Units: MCG/G DRY WEIGHT
P.O.: 85800-89-30058 Batch #: B-89030466

Customer ID: R5ABLI 04
Description: DEER LIVER TISSUE
ETSRC ID: 9030470

Elm	Result	Duplicate	% Deviation	Estimated Sample Detection Limit
AL	0.9	0.7	25.0	0.4
BE	<0.01	<0.01	0.0	0.01
CD	1.5	1.4	6.9	0.05
CR	0.2	0.44	75.0	0.1
CU	116.	108.	7.1	0.02
FE	241.	220.	9.1	0.1
MN	13.1	12.0	8.8	0.03
NI	<0.5	<0.4	0.0	0.4
PB	<0.5	<0.5	0.0	0.5
TL	<0.5	<0.5	0.0	0.5
ZN	119.	108.	9.7	0.08

Average % Deviation 12.9

Customer ID: R5ABLI 10
Description: DEER LIVER TISSUE
ETSRC ID: 9030475

Elm	Result	Duplicate	% Deviation	Estimated Sample Detection Limit
AL	3.4	0.6	140.0	0.4
BE	<0.01	<0.01	0.0	0.01
CD	2.7	2.7	0.0	0.07
CR	1.4	0.60	80.0	0.1
CU	260.	258.	0.8	0.02
FE	419.	418.	0.2	0.1
MN	10.8	11.0	1.8	0.03
NI	0.7	<0.4	***	0.4
PB	<0.5	<0.5	0.0	0.5
TL	<0.5	<0.5	0.0	0.5
ZN	104.	108.	3.8	0.2

Average % Deviation 22.7

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Quality Control Report
Environmental Trace Substances Research Center
ICP Scan - Duplicate Report

Project: USDI - Cat. 5814 Units: MCG/G DRY WEIGHT
P.O.: 85800-89-30058 Batch #: B-89030466

Customer ID: R5ABLI 26
Description: DEER LIVER TISSUE
ETSRC ID: 9030494

Elm	Result	Duplicate	% Deviation	Estimated Sample Detection Limit
AL	1.1	0.9	20.0	0.4
BE	<0.01	<0.01	0.0	0.01
CD	1.2	1.2	0.0	0.06
CR	0.44	0.38	14.6	0.1
CU	173.	172.	0.6	0.02
FE	403.	406.	0.7	0.1
MN	8.75	8.71	0.5	0.03
NI	<0.4	<0.4	0.0	0.4
PB	<0.5	<0.5	0.0	0.5
TL	<0.5	<0.5	0.0	0.5
ZN	93.2	93.7	0.5	0.1

Average % Deviation 3.4

Customer ID: R5ABMI 07
Description: DEER MUSCLE TISSUE
ETSRC ID: 9030504

Elm	Result	Duplicate	% Deviation	Estimated Sample Detection Limit
AL	4.0	4.1	2.5	0.4
BE	<0.01	<0.01	0.0	0.01
CD	<0.04	0.05	***	0.04
CR	1.7	2.4	34.1	0.1
CU	5.69	5.77	1.4	0.02
FE	136.	141.	3.6	0.1
MN	0.79	0.88	10.8	0.03
NI	0.7	1.	35.3	0.4
PB	<0.5	<0.5	0.0	0.5
TL	<0.4	<0.4	0.0	0.4
ZN	86.8	86.7	0.1	0.03

Average % Deviation 8.8

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Quality Control Report
Environmental Trace Substances Research Center
ICP Scan - Spike Report

Project: USDI - Cat. 5814 Units: MCG/G DRY WEIGHT
P.O.: 85800-89-30058 Batch #: B-89030466

Customer ID: R5ABLI 06
Description: DEER LIVER TISSUE
ETSRC ID: 9030471

Elm	Result	MCG Added	Spiked Sample	% Recovery	Estimated Sample Detection Limit
AL	1.2	100.0	207.	103.	0.4
BE	<0.01	5.0	10.4	104.	0.01
CD	0.42	10.0	20.9	103.	0.05
CR	0.68	50.0	103.	103.	0.1
CU	15.8	100.0	212.	98.	0.02
FE	187.	1000.0	2230.	103.	0.1
MN	14.3	50.0	116.	102.	0.04
NI	<0.4	50.0	102.	102.	0.5
PB	<0.5	50.0	96.1	96.	0.5
TL	<0.5	50.0	102.	102.	0.5
ZN	97.9	200.0	481.	96.	0.1

Average % Recovery 101.

- Not Spiked
* Possibly Not Spiked - Not in Average
*** Spike Too Low

Customer ID: R5ABLI 12
Description: DEER LIVER TISSUE
ETSRC ID: 9030477

Elm	Result	MCG Added	Spiked Sample	% Recovery	Estimated Sample Detection Limit
AL	1.2	100.0	204.	101.	0.4
BE	<0.01	5.0	10.4	103.	0.01
CD	1.2	10.0	21.1	99.	0.08
CR	2.0	50.0	102.	99.	0.1
CU	307.	100.0	500.	96.	0.02
FE	316.	1000.0	2330.	100.	0.1
MN	14.5	50.0	114.	99.	0.04
NI	1.4	50.0	101.	99.	0.5
PB	<0.5	50.0	93.4	93.	0.5
TL	<0.5	50.0	99.8	99.	0.6
ZN	112.	200.0	479.	91.	0.2

Average % Recovery 98.

- Not Spiked
* Possibly Not Spiked - Not in Average
*** Spike Too Low

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Quality Control Report
Environmental Trace Substances Research Center
ICP Scan - Spike Report

Project: USDI - Cat. 5814 Units: MCG/G DRY WEIGHT
P.O.: 85800-89-30058 Batch #: B-89030466

Customer ID: R5ABLI 28
Description: DEER LIVER TISSUE
ETSRC ID: 9030496

Elm	Result	MCG Added	Spiked Sample	% Recovery	Estimated Sample Detection Limit
AL	1.5	100.0	203.	101.	0.4
BE	<0.01	5.0	10.3	103.	0.01
CD	1.0	10.0	21.1	101.	0.08
CR	<0.1	50.0	98.7	99.	0.1
CU	314.	100.0	511.	99.	0.02
FE	417.	1000.0	2460.	102.	0.1
MN	11.9	50.0	113.	101.	0.04
NI	<0.4	50.0	101.	101.	0.4
PB	0.6	50.0	94.9	94.	0.5
TL	<0.5	50.0	101.	101.	0.5
ZN	131.	200.0	502.	93.	0.2

Average % Recovery 100.

\- Not Spiked
* Possibly Not Spiked - Not in Average
*** Spike Too Low

Customer ID: R5ABMI 12
Description: DEER MUSCLE TISSUE
ETSRC ID: 9030508

Elm	Result	MCG Added	Spiked Sample	% Recovery	Estimated Sample Detection Limit
AL	<0.4	100.0	207.	104.	0.4
BE	<0.01	5.0	10.1	102.	0.01
CD	<0.04	10.0	20.6	104.	0.05
CR	0.3	50.0	98.8	99.	0.1
CU	5.85	100.0	206.	101.	0.02
FE	98.0	1000.0	2160.	104.	0.1
MN	0.71	50.0	104.	104.	0.04
NI	<0.4	50.0	103.	104.	0.4
PB	<0.5	50.0	97.4	98.	0.5
TL	<0.4	50.0	103.	104.	0.5
ZN	62.5	200.0	449.	97.	0.1

Average % Recovery 102.

\- Not Spiked
* Possibly Not Spiked - Not in Average
*** Spike Too Low

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Quality Control Report
Environmental Trace Substances Research Center
ICP Scan - Blind QC Report

Project: USDI - Cat. 5814 Units: MCG/G DRY WEIGHT
P.O.: 85800-89-30058 Batch #: B-89030466

Customer ID: NRCC DOLT1
Description: NRCC DOGFISH LIVER
ETSRC ID: 9030467

Elm	Result	Expected Value	+/- STD.DEV.	Estimated Sample Detection Limit
AL	6.0			0.4
BE	<0.01			0.01
CD	4.2	4.18	0.28	0.04
CR	1.5	0.40	0.07	0.1
CU	18.3	20.8	1.2	0.02
FE	691.	712.	48.	0.1
MN	8.32	8.72	0.53	0.04
NI	0.7	0.26	0.06	0.4
PB	2.0	1.36	0.29	0.5
TL	<0.5			0.5
ZN	80.8	92.5	2.3	0.04

Customer ID: NRCC DORM1
Description: NRCC DOGFISH MUSCLE
ETSRC ID: 9030506

Elm	Result	Expected Value	+/- STD.DEV.	Estimated Sample Detection Limit
AL	6.1			0.4
BE	<0.01			0.01
CD	0.09	0.086	0.012	0.04
CR	3.2	3.60	0.40	0.1
CU	4.24	5.22	0.33	0.02
FE	54.0	63.6	5.3	0.1
MN	1.1	1.32	0.26	0.03
NI	1.	1.20	0.30	0.4
PB	<0.5	0.40	0.12	0.5
TL	<0.4			0.4
ZN	16.3	21.3	1.0	0.03

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Environmental Trace Substances Research Center
ICP Scan - Sample Analysis Report

Project: USDI - Cat. 5814 Units: MCG
P.O.: 85800-89-30058 Batch #: B-89030466

Customer ID: BLANK 1
Description: BLANK
ETSRC ID: 9030466

Elm	Result	Estimated Sample Detection Limit
AL	<0.2	0.2
BE	<0.005	0.005
CD	<0.02	0.02
CR	0.33	0.05
CU	<0.01	0.01
FE	0.21	0.05
MN	0.03	0.01
NI	<0.2	0.2
PB	<0.2	0.2
TL	<0.2	0.2
ZN	0.19	0.01

Customer ID: BLANK 2
Description: BLANK
ETSRC ID: 9030489

Elm	Result	Estimated Sample Detection Limit
AL	<0.2	0.2
BE	<0.005	0.005
CD	<0.02	0.02
CR	0.38	0.05
CU	<0.01	0.01
FE	<0.05	0.05
MN	0.02	0.01
NI	<0.2	0.2
PB	<0.2	0.2
TL	<0.2	0.2
ZN	<0.01	0.01

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Environmental Trace Substances Research Center
ICP Scan - Sample Analysis Report

Project: USDI - Cat. 5814 Units: MCG
P.O.: 85800-89-30058 Batch #: B-89030466

Customer ID: BLANK 3
Description: BLANK
ETSRC ID: 9030503

Elm	Result	Estimated Sample Detection Limit
AL	<0.2	0.2
BE	<0.005	0.005
CD	<0.02	0.02
CR	0.23	0.05
CU	<0.01	0.01
FE	0.96	0.05
MN	0.02	0.01
NI	<0.2	0.2
PB	<0.2	0.2
TL	<0.2	0.2
ZN	<0.01	0.01

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11 October, 1989

Dr. Greg Smith
Patuxent Analytical Control Facility
U.S. Fish and Wildlife Service
Patuxent Wildlife Research Center
Laurel, MD 20708

Dear Greg:

Enclosed are the results of the analyses of samples in Catalog 5814 and a brief discription of the methods used. The reporting limits are higher for the fat samples because of the lower sample weights.

Sincerely,

Terry L. Wade

Terry L. Wade, Ph.D.
Associate Research Scientist
Geochemical and Environmental
Research Group (GERG)

cc: J. Brooks
Texas A&M Research Foundation

received
10/13/89

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CATALOG # 5814

SAMPLE ANALYSES RESULTS

for

U.S. Fish and Wildlife Service

Prepared by

Geochemical and Environmental Research Group
Texas A&M University

OCTOBER 11, 1989

FISH & WILDLIFE SERVICES - CATALOG # 5814
BULK PARAMETERS

FILE	FWS SAMPLE ID	SAMPLE TYPE S,F,B,W	COMMENTS/DESCRIPTION	SAMPLE WT. (gr)	% MOISTURE	% LIPID
F2363	R5ABFO 02	B	Deer adipose tissue	0.52	24.72	64.48
F2364	R5ABFO 03	B	Deer adipose tissue	0.53	24.01	60.55
F2365	R5ABFO 04	B	Deer adipose tissue	0.58	16.43	77.22
F2366	R5ABFO 06	B	Deer adipose tissue	0.51	23.48	64.85
F2367	R5ABFO 07	B	Deer adipose tissue	0.53	20.43	75.40
F2368	R5ABFO 08	B	Deer adipose tissue	0.53	26.59	59.40
F2369	R5ABFO 09	B	Deer adipose tissue	0.55	28.19	58.38
F2370	R5ABFO 10	B	Deer adipose tissue	0.58	17.12	74.25
F2371	R5ABFO 11	B	Deer adipose tissue	0.52	19.48	68.41
F2372	R5ABFO 12	B	Deer adipose tissue	0.51	23.64	63.29
F2373	R5ABFO 13	B	Deer adipose tissue	0.58	17.43	67.80
F2374	R5ABFO 14	B	Deer adipose tissue	0.55	11.72	82.85
F2375	R5ABFO 15	B	Deer adipose tissue	0.55	18.23	82.39
F2376	R5ABFO 16	B	Deer adipose tissue	0.50	21.19	53.72
F2377	R5ABFO 17	B	Deer adipose tissue	0.53	11.98	79.70
F2378	R5ABFO 18	B	Deer adipose tissue	0.55	22.68	53.68
F2379	R5ABFO 19	B	Deer adipose tissue	0.56	21.27	69.44
F2380	R5ABFO 20	B	Deer adipose tissue	0.55	22.50	79.01
F2381	R5ABFO 21	B	Deer adipose tissue	0.53	19.68	73.58
F2382	R5ABFO 22	B	Deer adipose tissue	0.51	31.67	56.52
F2383	R5ABFO 23	B	Deer adipose tissue	0.51	16.82	75.91
F2384	R5ABFO 24	B	Deer adipose tissue	0.55	18.60	75.90
F2385	R5ABFO 25	B	Deer adipose tissue	0.54	23.66	66.91
F2386	R5ABFO 26	B	Deer adipose tissue	0.53	31.55	58.79
F2387	R5ABFO 27	B	Deer adipose tissue	0.56	10.51	83.83
F2388	R5ABFO 28	B	Deer adipose tissue	0.50	30.08	66.77
F2389	R5ABFO 29	B	Deer adipose tissue	0.53	21.69	65.03

* All data on a wet weight basis.

FISH & WILDLIFE SERVICES - CATALOG # 5814

BULK PARAMETERS

FILE	FWS SAMPLE ID	SAMPLE TYPE S,F,B,W	COMMENTS/DESCRIPTION	SAMPLE WT. (gr)	% MOISTURE	% LIPID
F2390	R5ABFO 30	B	Deer adipose tissue	0.52	9.45	82.42
F2391	R5ABFO 31	B	Deer adipose tissue	0.53	35.75	57.03
F2392	R5ABFO 32	B	Deer adipose tissue	0.53	20.07	72.73
F2393	R5ABMO 07	B	Deer muscle tissue	10.21	71.11	0.84
F2394	R5ABMO 09	B	Deer muscle tissue	7.28	71.04	1.55
F2395	R5ABMO 11	B	Deer muscle tissue	10.20	72.78	1.24
F2396	R5ABMO 12	B	Deer muscle tissue	10.34	71.83	1.42
F2397	R5ABMO 18	B	Deer muscle tissue	10.05	72.14	2.17
F2398	R5ABMO 19	B	Deer muscle tissue	10.03	71.08	1.10
F2399	R5ABMO 20	B	Deer muscle tissue	10.11	73.15	2.57
F2400	R5ABMO 21	B	Deer muscle tissue	9.83	71.32	1.27
F2401	R5ABMO 22	B	Deer muscle tissue	10.29	70.63	1.15
F2402	R5ABMO 32	B	Deer muscle tissue	10.35	71.78	1.42

* All data on a wet weight basis.

FISH & WILDLIFE SERVICES - CATALOG No 5814 - PESTICIDE & PCB ANALYSIS

- wet weight

RAW FILE #	DESCRIPTOR	ALPHA-BHC (ppm)	HCB (ppm)	BETA-BHC (ppm)	GAMMA-BHC (ppm)	DEL-BHC (ppm)	TOTAL BHC'S (ppm)	HEPTA-CHLOR (ppm)	ALDRIN (ppm)	HEPTA-EPOXIDE (ppm)	OXY-CHLORDANE (ppm)	GAMMA-CHLORDANE (ppm)
F2363P	R5ABFO 02	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
F2364P	R5ABFO 03	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
F2365P	R5ABFO 04	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
F2366P	R5ABFO 06	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.06	<0.05
F2367P	R5ABFO 07	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	<0.05
F2368P	R5ABFO 08	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.06	<0.05
F2369P	R5ABFO 09	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.06	<0.05
F2370P	R5ABFO 10	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.06	<0.05
F2371P	R5ABFO 11	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
F2372P	R5ABFO 12	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.18	<0.05
F2373P	R5ABFO 13	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
F2374P	R5ABFO 14	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.07	<0.05
F2375P	R5ABFO 15	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	*0.19
F2376P	R5ABFO 16	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
F2377P	R5ABFO 17	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
F2378P	R5ABFO 18	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
F2379P	R5ABFO 19	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
F2380P	R5ABFO 20	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.14	<0.05
F2381P	R5ABFO 21	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
F2382P	R5ABFO 22	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
F2383P	R5ABFO 23	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
F2384P	R5ABFO 24	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.19	<0.05
F2385P	R5ABFO 25	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
F2386P	R5ABFO 26	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
F2387P	R5ABFO 27	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
F2388P	R5ABFO 28	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
F2389P	R5ABFO 29	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
F2390P	R5ABFO 30	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05

FISH & WILDLIFE SERVICES - CATALOG No 5814 - PESTICIDE & PCB ANALYSIS

RAW FILE #	DESCRIPTOR	ALPHA-BHC (ppm)	HCB (ppm)	BETA-BHC (ppm)	GAMMA-BHC (ppm)	DEL-BHC (ppm)	TOTAL BHC'S (ppm)	HEPTA-CHLOR (ppm)	ALDRIN (ppm)	HEPTA-EPOXIDE (ppm)	OXY-CHLORDANE (ppm)	GAMMA-CHLORDANE (ppm)
F2391P	R5ABFO 31	<0.05	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.11	<0.05
F2392P	R5ABFO 32	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
F2393P	R5ABMO 07	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
F2394P	R5ABMO 09	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
F2395P	R5ABMO 11	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
F2396P	R5ABMO 12	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
F2397P	R5ABMO 18	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
F2398P	R5ABMO 19	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
F2399P	R5ABMO 20	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
F2400P	R5ABMO 21	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
F2401P	R5ABMO 22	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
F2402P	R5ABMO 32	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

* Confirmed by GC/MS

RAW FILE #	DESCRIPTOR	ALPHA-CHLORDANE (ppm)	TRANS-NONACHLOR (ppm)	DIELDRIN (ppm)	ENDRIN (ppm)	CIS-NONACHLOR (ppm)	MIREX (ppm)	2,4' DDE (O,P' DDE) (ppm)	4,4' DDE (P,P' DDE) (ppm)	2,4' DDD (O,P DDD) (ppm)	4,4' DDD (P,P' DDD) (ppm)	2,4' DDT (O,P' DDT) (ppm)
F2363P	R5ABFO 02	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
F2364P	R5ABFO 03	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
F2365P	R5ABFO 04	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
F2366P	R5ABFO 06	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
F2367P	R5ABFO 07	<0.05	<0.05	0.09	<0.05	<0.05	<0.05	0.05	<0.05	<0.05	<0.05	<0.05
F2368P	R5ABFO 08	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
F2369P	R5ABFO 09	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.10	<0.05	<0.05
F2370P	R5ABFO 10	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
F2371P	R5ABFO 11	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
F2372P	R5ABFO 12	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
F2373P	R5ABFO 13	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
F2374P	R5ABFO 14	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
F2375P	R5ABFO 15	*0.12	*0.09	*0.10	<0.05	<0.05	<0.05	<0.05	<0.05	*.23	<0.05	*0.06
F2376P	R5ABFO 16	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
F2377P	R5ABFO 17	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
F2378P	R5ABFO 18	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
F2379P	R5ABFO 19	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
F2380P	R5ABFO 20	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
F2381P	R5ABFO 21	<0.05	<0.05	0.10	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
F2382P	R5ABFO 22	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
F2383P	R5ABFO 23	<0.05	<0.05	0.27	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
F2384P	R5ABFO 24	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
F2385P	R5ABFO 25	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
F2386P	R5ABFO 26	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
F2387P	R5ABFO 27	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
F2388P	R5ABFO 28	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
F2389P	R5ABFO 29	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
F2390P	R5ABFO 30	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05

RAW FILE #	DESCRIPTOR	ALPHA-CHLORDANE (ppm)	TRANS-NONACHLOR (ppm)	DIELDRIN (ppm)	ENDRIN (ppm)	CIS-NONACHLOR (ppm)	MIREX (ppm)	2,4' DDE (O,P' DDE) (ppm)	4,4' DDE (P,P' DDE) (ppm)	2,4' DDD (O,P DDD) (ppm)	4,4' DDD (P,P' DDD) (ppm)	2,4' DDT (O,P' DDT) (ppm)
F2391P	R5ABFO 31	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
F2392P	R5ABFO 32	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
F2393P	R5ABMO 07	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
F2394P	R5ABMO 09	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
F2395P	R5ABMO 11	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
F2396P	R5ABMO 12	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
F2397P	R5ABMO 18	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
F2398P	R5ABMO 19	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
F2399P	R5ABMO 20	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
F2400P	R5ABMO 21	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
F2401P	R5ABMO 22	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
F2402P	R5ABMO 32	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

* Confirmed by GC/MS

FISH & WILDLIFE SERVICES - CATALOG No 5814 - PESTICIDE & PCB ANALYSIS

RAW FILE #	DESCRIPTOR	4,4' DDT (P,P' DDT) (ppm)	TOTAL CL2 BIPH (ppm)	TOTAL CL3 BIPH (ppm)	TOTAL CL4 BIPH (ppm)	TOTAL CL5 BIPH (ppm)	TOTAL CL6 BIPH (ppm)	TOTAL CL7 BIPH (ppm)	TOTAL CL8 BIPH (ppm)	TOTAL CL9 BIPH (ppm)	TOTAL PCB'S (ppm)	TOXA-PHENE (ppm)
F2363P	R5ABFO 02	<0.05	<0.05	<0.05	<0.05	<0.05	0.14	<0.05	<0.05	<0.05	<0.50	<0.50
F2364P	R5ABFO 03	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.50	<0.50
F2365P	R5ABFO 04	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.50	<0.50
F2366P	R5ABFO 06	*0.08	<0.05	<0.05	<0.05	0.83	0.26	<0.05	<0.05	<0.05	*1.09	<0.50
F2367P	R5ABFO 07	<0.05	<0.05	0.08	0.22	0.08	0.39	<0.05	<0.05	<0.05	0.77	<0.50
F2368P	R5ABFO 08	0.05	<0.05	<0.05	<0.05	0.06	0.29	<0.05	<0.05	<0.05	<0.50	<0.50
F2369P	R5ABFO 09	<0.05	<0.05	<0.05	<0.05	0.06	0.21	<0.05	<0.05	<0.05	<0.50	<0.50
F2370P	R5ABFO 10	<0.05	<0.05	<0.05	<0.05	0.09	0.15	<0.05	<0.05	<0.05	<0.50	<0.50
F2371P	R5ABFO 11	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.50	<0.50
F2372P	R5ABFO 12	<0.05	<0.05	<0.05	<0.05	0.06	0.18	<0.05	<0.05	<0.05	<0.50	<0.50
F2373P	R5ABFO 13	<0.05	<0.05	0.10	0.48	0.24	0.28	0.15	0.05	<0.05	*1.30	<0.50
F2374P	R5ABFO 14	0.09	<0.05	<0.05	0.38	<0.05	0.14	<0.05	<0.05	<0.05	0.51	<0.50
F2375P	R5ABFO 15	*0.07	<0.05	<0.05	2.13	0.83	0.90	<0.05	<0.05	<0.05	*3.86	<0.50
F2376P	R5ABFO 16	<0.05	<0.05	<0.05	<0.05	<0.05	0.10	<0.05	<0.05	<0.05	<0.50	<0.50
F2377P	R5ABFO 17	<0.05	<0.05	<0.05	0.08	0.19	0.16	0.05	<0.05	<0.05	<0.50	<0.50
F2378P	R5ABFO 18	<0.05	<0.05	<0.05	<0.05	<0.05	0.08	<0.05	<0.05	<0.05	<0.50	<0.50
F2379P	R5ABFO 19	<0.05	<0.05	<0.05	<0.05	<0.05	0.06	<0.05	<0.05	<0.05	<0.50	<0.50
F2380P	R5ABFO 20	<0.05	<0.05	<0.05	<0.05	<0.05	0.06	<0.05	<0.05	<0.05	<0.50	<0.50
F2381P	R5ABFO 21	0.08	<0.05	<0.05	0.27	0.10	0.21	<0.05	<0.05	<0.05	0.58	<0.50
F2382P	R5ABFO 22	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	<0.05	<0.05	<0.05	<0.50	<0.50
F2383P	R5ABFO 23	<0.05	<0.05	<0.05	<0.05	<0.05	0.07	<0.05	<0.05	<0.05	<0.50	<0.50
F2384P	R5ABFO 24	<0.05	<0.05	<0.05	<0.05	<0.05	0.07	<0.05	<0.05	<0.05	<0.50	<0.50
F2385P	R5ABFO 25	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.50	<0.50
F2386P	R5ABFO 26	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.50	<0.50
F2387P	R5ABFO 27	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.50	<0.50
F2388P	R5ABFO 28	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.50	<0.50
F2389P	R5ABFO 29	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.50	<0.50
F2390P	R5ABFO 30	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.50	<0.50

RAW FILE #	DESCRIPTOR	4,4' DDT (P,P' DDT) (ppm)	TOTAL CL2 BIPH (ppm)	TOTAL CL3 BIPH (ppm)	TOTAL CL4 BIPH (ppm)	TOTAL CL5 BIPH (ppm)	TOTAL CL6 BIPH (ppm)	TOTAL CL7 BIPH (ppm)	TOTAL CL8 BIPH (ppm)	TOTAL CL9 BIPH (ppm)	TOTAL PCB'S (ppm)	TOXA-PHENE (ppm)
F2391P	R5ABFO 31	<0.05	<0.05	<0.05	<0.05	<0.05	0.14	<0.05	<0.05	<0.05	<0.50	<0.50
F2392P	R5ABFO 32	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.50	<0.50
F2393P	R5ABMO 07	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.10	<0.10
F2394P	R5ABMO 09	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.10	<0.10
F2395P	R5ABMO 11	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.10	<0.10
F2396P	R5ABMO 12	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.10	<0.10
F2397P	R5ABMO 18	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.10	<0.10
F2398P	R5ABMO 19	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.10	<0.10
F2399P	R5ABMO 20	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.10	<0.10
F2400P	R5ABMO 21	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.10	<0.10
F2401P	R5ABMO 22	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.10	<0.10
F2402P	R5ABMO 32	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.10	<0.10

* Confirmed by GC/MS

QUALITY CONTROL /QUALITY ASSURANCE

(C-1)

91

Let's protect our earth

State of New Jersey

DEPARTMENT OF ENVIRONMENTAL PROTECTION

DIVISION OF
FISH, GAME AND WILDLIFE
GEORGE P. HOWARD
DIRECTOR

PLEASE REPLY TO:
CN 400
TRENTON, NEW JERSEY 08625

Freshwater Fisheries Laboratory
PO Box 394
Lebanon, NJ 08833

August 18, 1989

Michael Chezik
US Fish and Wildlife Service
PO Box 534
705 White Horse Pike
Absecon, NJ 08201

Dear Mike:

Enclosed are the results of the Cd analyses we performed on the 32 deer liver samples that were submitted to our lab in March 1989. I have also included a description of the analytical method and the results of QA/QC analyses that were performed.

We look forward to seeing the results of the analyses performed by your own lab. If you have any questions regarding these data, give me a call at (201) 236-2118.

Sincerely,

Bill Stansley

William Stansley
Wildlife Toxicologist

QA/QC

Digestion Blanks

Six digestion blanks were processed and analyzed along with the liver samples. Cd was not detected in any of the blanks.

Standard Reference Material

Five subsamples of bovine liver standard reference material (National Bureau of Standards SRM 1577a) were analyzed along with the liver samples. The NBS certified value is 0.44 $\pm$ 0.06 µg/g. The value determined at our lab was 0.42 $\pm$ 0.04 µg/g.

Precision

Duplicate subsamples of liver were dissected from seven of the liver samples that were submitted. The results of these analyses are as follows:

Sample #	Conc. 1	Conc. 2
LI 12	1.30	1.27
LI 29	0.78	0.81
LI 06	0.43	0.41
LI 04	1.27	1.28
LI 22	1.08	1.04
LI 08	1.61	1.61
LI 10	2.55	2.68

Mean Relative Percent Difference = 2.9%

Matrix Spikes

Six aliquots of digestate were spiked with known amounts of Cd and percent recoveries were calculated.

Sample #	Initial Conc. in Digestate (µg/L)	Spike Conc. (µg/L)	Final Conc in Digestate (µg/L)
LI 24	0.33	1.0	1.38
LI 29	0.76	0.5	1.28
LI 06 DUP	0.36	1.0	1.43
LI 32	0.59	0.5	1.17
LI 18	0.51	0.5	1.06
LI 01	0.69	0.5	1.28

Mean Percent Recovery = 110%

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UNIVERSITY OF MISSOURI

Environmental Trace Substances Research Center

Route 3
Columbia, Missouri 65203
Telephone (314) 882-2151

September 21, 1989

Gregory Smith
U.S. Department of the Interior
Patuxent Wildlife Research Center
Laurel, Maryland 20708

Dear Dr. Smith:

Enclosed are data, quality control reports, procedures and invoice for Cat. 5814, P.O. #85800-89-30058, Region I.D. #89-5-100.

Let me know if you have any questions.

Sincerely,

Edward J. Hinderberger

Edward J. Hinderberger, Jr.
Group Leader

EJH:ske

Enclosures

received
9/26/89

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U. S. FISH AND WILDLIFE SERVICE
PATUXENT ANALYTICAL CONTROL FACILITY

QUALITY ASSURANCE REPORT

RE: 5814 REGION: 5 REGIONAL ID: 89-5-100

THE ANALYSES ON THE ABOVE MENTIONED SAMPLES WERE PERFORMED AT:

THE ENVIRONMENTAL TRACE SUBSTANCES RESEARCH CENTER
ROUTE 3
COLUMBIA, MISSOURI 65201

AFTER A THOROUGH REVIEW OF THE REPORTS ISSUED BY THE LABORATORY, I REPORT THE FOLLOWING OBSERVATIONS AND CONCLUSIONS:

THE ACCURACY, AS MEASURED BY SPIKE RECOVERY AND REFERENCE MATERIAL ANALYSIS, WAS ACCEPTABLE FOR ALL ANALYTES. AVERAGE RECOVERY FOR SPIKED SAMPLE ANALYSES IS GIVEN IN TABLE 1.

THE PRECISION, AS MEASURED BY DUPLICATE SAMPLE ANALYSIS, WAS ACCEPTABLE FOR MOST ANALYTES. ALUMINUM AND CHROMIUM RESULTS WERE SUBSTANTIALLY MORE VARIABLE THAN USUAL. THESE RESULTS SHOULD NOT BE USED. AN ESTIMATE OF THE 95 % CONFIDENCE INTERVAL FOR THE METHODS USED IN THESE ANALYSES IS GIVEN IN TABLE 2.

John F Moore 9-27-89

JOHN F. MOORE DATE

TABLE 1: AVERAGE RECOVERY OF SPIKED ANALYTE FROM TISSUES ANALYZED BY THE ENVIRONMENTAL TRACE SUBSTANCES RESEARCH CENTER

	AVERAGE	STANDARD DEVIATION	NUMBER
ATOMIC ABSORPTION ANALYSES			
Arsenic	100	5.9	136
Selenium	95	3.4	153
Mercury	105	4.4	127
ICP ANALYSES(NO PRECON)			
Aluminum	103	5.3	98
Beryllium	102	5.9	111
Cadmium	102	4.6	111
Chromium	100	5.2	111
Copper	106	4.3	111
Iron	103	5.6	102
Lead	103	5.6	111
Manganese	101	4.8	101
Nickel	102	5.3	111
Zinc	105	6.2	110
Boron	91	6.1	110
Barium	102	4.1	99
Magnesium	101	6.2	98
Molybdenum	101	6.2	111
Silver	94	14.	111
Strontium	103	3.9	82
Thallium	99	3.0	111
Vanadium	104	5.2	110
Arsenic	101	11.	111
Selenium	104	7.7	111
PRECON ICP ANALYSES			
Aluminum	104	3.5	44
Beryllium	104	4.1	48
Cadmium	101	5.3	90
Chromium	99	7.2	48
Copper	103	4.1	90
Iron	103	7.6	87
Lead	99	5.4	90
Manganese	99	5.1	46
Nickel	101	4.8	90
Zinc	102	5.2	89
Molybdenum	102	4.4	42
Thallium	99	4.0	90
Vanadium	100	6.3	42
Selenium	98	6.4	37

TABLE 2: ESTIMATED 95 % CONFIDENCE INTERVAL FOR TISSUE ANALYSES PERFORMED BY THE ENVIRONMENTAL TRACE SUBSTANCES RESEARCH CENTER

SAMPLE CONCENTRATION*	± CONFIDENCE INTERVAL AS % OF SAMPLE CONCENTRATION 2-10 LOD	>10 LOD
ATOMIC ABSORPTION ANALYSES	20	5
Arsenic	INS	10
Selenium	INS	5
Mercury	INS	5
ICP ANALYSES(NO PRECON)	20	5
Aluminum	INS	15
Beryllium	INS	INS
Cadmium	INS	INS
Chromium	INS	INS
Copper	10	5
Iron	INS	5
Lead	INS	INS
Manganese	INS	5
Nickel	INS	INS
Zinc	INS	5
Boron	20	INS
Barium	50	10
Magnesium	INS	5
Molybdenum	INS	INS
Silver	INS	INS
Strontium	15	10
Thallium	INS	INS
Vanadium	30	10
Arsenic	INS	INS
Selenium	INS	INS
PRECON ICP ANALYSES	40	10
Aluminum	INS	15
Beryllium	INS	35
Cadmium	INS	INS
Chromium	INS	INS
Copper	INS	10
Iron	INS	10
Lead	INS	INS
Manganese	INS	10
Nickel	45	30
Zinc	INS	5
Molybdenum	INS	5
Thallium	INS	INS
Vanadium	INS	INS
Selenium	15	5

* FOR ANY CONCENTRATION LESS THAN 2 LOD, THE 95 % CONFIDENCE INTERVAL IS ESTIMATED AT ± 2 LOD.

LOD= LIMIT OF DETECTION

INS=INSUFFICIENT DATA TO CALCULATE ON AN INDIVIDUAL ANALYTE BASIS

98.

ETSRC Sample Report

USDI - Cat. 5814 P.O. 85800-89-30058
B-89030466 MOISTURE

Submitter's ID Number	ETSRC ID	Test	Final Concen.	Units of Fin.Conc.	Description
R5ABLI 02	9030468	MOIST	71.8	%	DEER LIVER TISSUE
R5ABLI 03	9030469	MOIST	67.2	%	DEER LIVER TISSUE
R5ABLI 04	9030470	MOIST	68.6	%	DEER LIVER TISSUE
R5ABLI 06	9030471	MOIST	67.9	%	DEER LIVER TISSUE
R5ABLI 07	9030472	MOIST	68.5	%	DEER LIVER TISSUE
R5ABLI 08	9030473	MOIST	67.1	%	DEER LIVER TISSUE
R5ABLI 09	9030474	MOIST	72.1	%	DEER LIVER TISSUE
R5ABLI 10	9030475	MOIST	66.2	%	DEER LIVER TISSUE
R5ABLI 11	9030476	MOIST	71.3	%	DEER LIVER TISSUE
R5ABLI 12	9030477	MOIST	64.1	%	DEER LIVER TISSUE
R5ABLI 13	9030478	MOIST	69.8	%	DEER LIVER TISSUE
R5ABLI 14	9030479	MOIST	69.1	%	DEER LIVER TISSUE
R5ABLI 15	9030480	MOIST	67.9	%	DEER LIVER TISSUE
R5ABLI 16	9030481	MOIST	72.0	%	DEER LIVER TISSUE
R5ABLI 17	9030482	MOIST	71.9	%	DEER LIVER TISSUE
R5ABLI 18	9030483	MOIST	70.4	%	DEER LIVER TISSUE
R5ABLI 19	9030484	MOIST	74.3	%	DEER LIVER TISSUE
R5ABLI 20	9030485	MOIST	70.3	%	DEER LIVER TISSUE
R5ABLI 21	9030486	MOIST	69.5	%	DEER LIVER TISSUE
R5ABLI 22	9030490	MOIST	72.8	%	DEER LIVER TISSUE
R5ABLI 23	9030491	MOIST	70.0	%	DEER LIVER TISSUE
R5ABLI 24	9030492	MOIST	71.2	%	DEER LIVER TISSUE
R5ABLI 25	9030493	MOIST	68.7	%	DEER LIVER TISSUE
R5ABLI 26	9030494	MOIST	68.4	%	DEER LIVER TISSUE
R5ABLI 27	9030495	MOIST	71.8	%	DEER LIVER TISSUE
R5ABLI 28	9030496	MOIST	69.6	%	DEER LIVER TISSUE
R5ABLI 29	9030497	MOIST	70.7	%	DEER LIVER TISSUE
R5ABLI 30	9030498	MOIST	69.4	%	DEER LIVER TISSUE
R5ABLI 31	9030499	MOIST	71.3	%	DEER LIVER TISSUE
R5ABLI 32	9030500	MOIST	71.5	%	DEER LIVER TISSUE
R5ABMI 07	9030504	MOIST	74.6	%	DEER MUSCLE TISSUE
R5ABMI 09	9030505	MOIST	74.9	%	DEER MUSCLE TISSUE
R5ABMI 11	9030507	MOIST	75.2	%	DEER MUSCLE TISSUE
R5ABMI 12	9030508	MOIST	74.6	%	DEER MUSCLE TISSUE
R5ABMI 18	9030509	MOIST	75.5	%	DEER MUSCLE TISSUE
R5ABMI 19	9030510	MOIST	77.6	%	DEER MUSCLE TISSUE
R5ABMI 20	9030511	MOIST	75.2	%	DEER MUSCLE TISSUE
R5ABMI 21	9030512	MOIST	76.2	%	DEER MUSCLE TISSUE
R5ABMI 22	9030513	MOIST	78.8	%	DEER MUSCLE TISSUE
R5ABMI 32	9030514	MOIST	75.7	%	DEER MUSCLE TISSUE

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ETSRC Sample Report

USDI - Cat. 5814 P.O. 85800-89-30058
B-89030466

Submitter's ID Number	ETSRC ID	Test	Final Concen.	Units of Fin.Conc.	Description
R5ABLI 02	9030468	HG	0.018	MCG/G DW	DEER LIVER TISSUE
R5ABLI 03	9030469	HG	0.01	MCG/G DW	DEER LIVER TISSUE
R5ABLI 04	9030470	HG	0.023	MCG/G DW	DEER LIVER TISSUE
R5ABLI 06	9030471	HG	0.016	MCG/G DW	DEER LIVER TISSUE
R5ABLI 07	9030472	HG	0.022	MCG/G DW	DEER LIVER TISSUE
R5ABLI 08	9030473	HG	0.024	MCG/G DW	DEER LIVER TISSUE
R5ABLI 09	9030474	HG	0.01	MCG/G DW	DEER LIVER TISSUE
R5ABLI 10	9030475	HG	0.021	MCG/G DW	DEER LIVER TISSUE
R5ABLI 11	9030476	HG	0.020	MCG/G DW	DEER LIVER TISSUE
R5ABLI 12	9030477	HG	0.016	MCG/G DW	DEER LIVER TISSUE
R5ABLI 13	9030478	HG	0.016	MCG/G DW	DEER LIVER TISSUE
R5ABLI 14	9030479	HG	0.024	MCG/G DW	DEER LIVER TISSUE
R5ABLI 15	9030480	HG	0.022	MCG/G DW	DEER LIVER TISSUE
R5ABLI 16	9030481	HG	0.017	MCG/G DW	DEER LIVER TISSUE
R5ABLI 17	9030482	HG	0.016	MCG/G DW	DEER LIVER TISSUE
R5ABLI 18	9030483	HG	0.017	MCG/G DW	DEER LIVER TISSUE
R5ABLI 19	9030484	HG	0.015	MCG/G DW	DEER LIVER TISSUE
R5ABLI 20	9030485	HG	0.015	MCG/G DW	DEER LIVER TISSUE
R5ABLI 21	9030486	HG	0.024	MCG/G DW	DEER LIVER TISSUE
R5ABLI 22	9030490	HG	0.045	MCG/G DW	DEER LIVER TISSUE
R5ABLI 23	9030491	HG	0.008	MCG/G DW	DEER LIVER TISSUE
R5ABLI 24	9030492	HG	0.01	MCG/G DW	DEER LIVER TISSUE
R5ABLI 25	9030493	HG	0.023	MCG/G DW	DEER LIVER TISSUE
R5ABLI 26	9030494	HG	0.01	MCG/G DW	DEER LIVER TISSUE
R5ABLI 27	9030495	HG	0.032	MCG/G DW	DEER LIVER TISSUE
R5ABLI 28	9030496	HG	1.9	MCG/G DW	DEER LIVER TISSUE
R5ABLI 29	9030497	HG	0.32	MCG/G DW	DEER LIVER TISSUE
R5ABLI 30	9030498	HG	0.033	MCG/G DW	DEER LIVER TISSUE
R5ABLI 31	9030499	HG	0.043	MCG/G DW	DEER LIVER TISSUE
R5ABLI 32	9030500	HG	0.021	MCG/G DW	DEER LIVER TISSUE
R5ABMI 07	9030504	HG	0.009	MCG/G DW	DEER MUSCLE TISSUE
R5ABMI 09	9030505	HG	0.008	MCG/G DW	DEER MUSCLE TISSUE
R5ABMI 11	9030507	HG	0.006	MCG/G DW	DEER MUSCLE TISSUE
R5ABMI 12	9030508	HG	0.006	MCG/G DW	DEER MUSCLE TISSUE
R5ABMI 18	9030509	HG	0.009	MCG/G DW	DEER MUSCLE TISSUE
R5ABMI 19	9030510	HG	0.008	MCG/G DW	DEER MUSCLE TISSUE
R5ABMI 20	9030511	HG	0.008	MCG/G DW	DEER MUSCLE TISSUE
R5ABMI 21	9030512	HG	0.007	MCG/G DW	DEER MUSCLE TISSUE
R5ABMI 22	9030513	HG	0.008	MCG/G DW	DEER MUSCLE TISSUE
R5ABMI 32	9030514	HG	0.008	MCG/G DW	DEER MUSCLE TISSUE

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ETSRC Quality Control Report -- Duplicates

USDI - Cat. 5814 P.O. 85800-89-30058
B-89030466

Submitter's ID Number	ETSRC ID	Test	Final Concen.	Units of Fin.Conc.	Description
R5ABLI 04	9030470	HG	0.023	MCG/G DW	DEER LIVER TISSUE
R5ABLI 04	9030470D	HG	0.023	MCG/G DW	DEER LIVER TISSUE
Percent Deviation	0.0				
R5ABLI 10	9030475	HG	0.020	MCG/G DW	DEER LIVER TISSUE
R5ABLI 10	9030475D	HG	0.022	MCG/G DW	DEER LIVER TISSUE
Percent Deviation	9.5				
R5ABLI 26	9030494	HG	0.01	MCG/G DW	DEER LIVER TISSUE
R5ABLI 26	9030494D	HG	0.01	MCG/G DW	DEER LIVER TISSUE
Percent Deviation	0.0				
R5ABMI 07	9030504	HG	0.008	MCG/G DW	DEER MUSCLE TISSUE
R5ABMI 07	9030504D	HG	0.009	MCG/G DW	DEER MUSCLE TISSUE
Percent Deviation	11.8				

Average Percent Deviations 5.3

Standard Deviation of % 6.2

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ETSRC Quality Control Report -- Spikes

USDI - Cat. 5814 P.O. 85800-89-30058
B-89030466

Submitter's ID Number	ETSRC ID	Test	Final Concen.	Units of Fin.Conc.	Description
R5ABLI 06	9030471	HG	0.016	MCG/G DW	DEER LIVER TISSUE
R5ABLI 06	9030471S	HG	2.19	MCG/G DW	DEER LIVER TISSUE
MCG of Spike Added	1.00		Percent Spike Recovery	110.	
R5ABLI 12	9030477	HG	0.016	MCG/G DW	DEER LIVER TISSUE
R5ABLI 12	9030477S	HG	2.09	MCG/G DW	DEER LIVER TISSUE
MCG of Spike Added	1.00		Percent Spike Recovery	105.	
R5ABLI 28	9030496	HG	1.9	MCG/G DW	DEER LIVER TISSUE
R5ABLI 28	9030496S	HG	4.0	MCG/G DW	DEER LIVER TISSUE
MCG of Spike Added	1.00		Percent Spike Recovery	106.	
R5ABMI 12	9030508	HG	0.006	MCG/G DW	DEER MUSCLE TISSUE
R5ABMI 12	9030508S	HG	2.15	MCG/G DW	DEER MUSCLE TISSUE
MCG of Spike Added	1.00		Percent Spike Recovery	107.	

Average Percent Spike Recovery 107.

Standard Deviation of Recovery 2.1

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ETSRC Quality Control Report -- Reference Standards

USDI - Cat. 5814 P.O. 85800-89-30058
B-89030466

Reference ID Number	ETSRC ID	Test	Final Concen.	Units of Fin.Conc.	Expected Value	Standard Deviation	Description
NRCC DORM1	9030467A	HG	0.824	MCG/G DW	0.798	0.074	NRCC DOGFISH
NRCC DORM1	9030506	HG	0.816	MCG/G DW	0.798	0.074	NRCC DOGFISH

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ETSRC Quality Control Report -- Blanks

USDI - Cat. 5814 P.O. 85800-89-30058
B-89030466

Submitter's ID Number	ETSRC ID	Test	Final Concen.	Units of Fin.Conc.	Description
BLANK 1	9030466	HG	0.014	MCG	BLANK 1
BLANK 2	9030489	HG	0.017	MCG	BLANK 2
BLANK 3	9030503	HG	0.017	MCG	BLANK 3

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CATALOG # 5814

QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

for

U.S. Fish and Wildlife Service

Prepared by

Geochemical and Environmental Research Group
Texas A&M University

OCTOBER 11, 1989

105

U. S. FISH AND WILDLIFE SERVICE
PATUXENT ANALYTICAL CONTROL FACILITY

QUALITY ASSURANCE REPORT

RE: 5814 REGION: 5 REGIONAL ID: 89-5-100

THE ANALYSES ON THE ABOVE MENTIONED SAMPLES WERE PERFORMED AT:

TEXAS A & M RESEARCH FOUNDATION
10 SOUTH GRAHAM RD
COLLEGE STATION, TX 77840

AFTER A THOROUGH REVIEW OF THIS REPORT, I REPORT THE FOLLOWING OBSERVATIONS AND CONCLUSIONS:

THE ACCURACY, AS MEASURED BY SPIKE RECOVERY ANALYSIS, WAS GENERALLY ACCEPTABLE. RECOVERIES OF ALPHA BHC, BETA BHC, DELTA BHC, AND HCB IN TISSUES HAVE AVERAGED LESS THAN 80 %. THE METHOD SHOULD NOT BE CONSIDERED QUANTITATIVE FOR THESE ANALYTES. THE ATTACHED TABLE CONTAINS THE AVERAGE SPIKE RECOVERIES FOR THESE METHODS.

THE PRECISION, AS MEASURED BY DUPLICATE SAMPLE ANALYSIS, WAS ACCEPTABLE.

WE HAVE NOT RECEIVED SUFFICIENT DATA FROM THIS LABORATORY TO ESTIMATE CONFIDENCE INTERVALS.

Clifford P Rice 10/23/89
QUALITY ASSURANCE OFFICER DATE

⇒ Spoke w/ Terry Wade @ Texas A&M 11/6/89
- all residues reported on a wet weight basis.
T. Augspurger

TABLE 1: AVERAGE RECOVERY OF SPIKED ANALYTE FROM TISSUES ANALYZED BY THE GEOCHEMICAL AND ENVIRONMENTAL RESEARCH GROUP TEXAS A&M UNIVERSITY

ANALYTE	AVERAGE	STANDARD DEVIATION	NUMBER
alpha BHC	74.6	21.3	42
HCB	59.7	25.5	21
beta BHC	79.3	21.9	42
delta BHC	41.5	36.1	42
Heptachlor	86.9	23.9	44
Aldrin	101.7	11.3	44
Heptachlor epoxide	106.9	13.2	44
gamma Chlordane	94.4	8.3	21
alpha Chlordane	110.1	22.3	21
trans Nonachlor	107.5	7.4	21
Dieldrin	101.3	13.5	44
Endrin	86.9	12.0	7
Mirex	102.9	9.6	18
o,p′ DDE	108.0	11.1	20
p,p′ DDE	106.5	15.1	44
o,p′ DDD	85.9	24.1	21
p,p′ DDD	96.2	18.9	44
o,p′ DDT	106.7	8.7	21
p,p′ DDT	95.2	21.8	44
Total PCB	103.6	18.7	52

FISH & WILDLIFE SERVICES - CATALOG # 5814
BULK PARAMETERS

FILE	FWS SAMPLE ID	SAMPLE TYPE S,F,B,W	COMMENTS/DESCRIPTION	SAMPLE WT. (gr)	% MOISTURE	% LIPID
Replicates						
F2371	R5ABFO 11	B	Deer adipose tissue	0.52	19.48	68.41
F2403	R5ABFO 11	B	Deer adipose tissue	0.55	19.57	71.31
F2381	R5ABFO 21	B	Deer adipose tissue	0.53	19.68	73.58
F2404	R5ABFO 21	B	Deer adipose tissue	0.50	21.50	75.14
F2391	R5ABFO 31	B	Deer adipose tissue	0.53	35.75	57.03
F2405	R5ABFO 31	B	Deer adipose tissue	0.54	35.53	60.00
F2406	R5ABFO 31	B	Deer adipose tissue	0.56	36.97	53.00
F2401	R5ABMO 22	B	Deer muscle tissue	10.29	70.63	1.15
F2407	R5ABMO 22	B	Deer muscle tissue	7.71	71.23	1.40

* All data on a wet weight basis.

FISH & WILDLIFE SERVICES - REPLICATES - PESTICIDE & PCB ANALYSIS

RAW FILE #	DESCRIPTOR	ALPHA-BHC (ppm)	HCB (ppm)	BETA-BHC (ppm)	GAMMA-BHC (ppm)	DEL-BHC (ppm)	TOTAL BHC'S (ppm)	HEPTA-CHLOR (ppm)	ALDRIN (ppm)	HEPTA-EPOXIDE (ppm)	OXY-CHLORDANE (ppm)	GAMMA-CHLORDANE (ppm)
F2371P	R5ABFO 11	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
F2403P	R5ABFO 11	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
F2381P	R5ABFO 21	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
F2404P	R5ABFO 21	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
F2391P	R5ABFO 31	<0.05	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.11	<0.05
F2405P	R5ABFO 31	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.15	<0.05
F2406P	R5ABFO 31	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.16	<0.05
F2394P	R5ABMO 09	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
F2407P	R5ABMO 09	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

FISH & WILDLIFE SERVICES - REPLICATES - PESTICIDE & PCB ANALYSIS

RAW FILE #	DESCRIPTOR	ALPHA-CHLORDANE (ppm)	TRANS-NONACHLOR (ppm)	DIELDRIN (ppm)	ENDRIN (ppm)	CIS-NONACHLOR (ppm)	MIREX (ppm)	2,4' DDE (O,P' DDE) (ppm)	4,4' DDE (P,P' DDE) (ppm)	2,4' DDD (O,P DDD) (ppm)	4,4' DDD (P,P' DDD) (ppm)	2,4' DDT (O,P' DDT) (ppm)
F2371P	R5ABFO 11	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
F2403P	R5ABFO 11	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
F2381P	R5ABFO 21	<0.05	<0.05	0.10	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
F2404P	R5ABFO 21	<0.05	<0.05	0.08	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
F2391P	R5ABFO 31	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
F2405P	R5ABFO 31	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
F2406P	R5ABFO 31	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
F2394P	R5ABMO 09	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
F2407P	R5ABMO 09	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

FISH & WILDLIFE SERVICES - REPLICATES - PESTICIDE & PCB ANALYSIS

RAW FILE #	DESCRIPTOR	4,4' DDT (P,P' DDT) (ppm)	TOTAL CL2 BIPH (ppm)	TOTAL CL3 BIPH (ppm)	TOTAL CL4 BIPH (ppm)	TOTAL CL5 BIPH (ppm)	TOTAL CL6 BIPH (ppm)	TOTAL CL7 BIPH (ppm)	TOTAL CL8 BIPH (ppm)	TOTAL CL9 BIPH (ppm)	TOTAL PCB'S (ppm)	TOXA-PHENE (ppm)
F2371P	R5ABFO 11	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.50	<0.50
F2403P	R5ABFO 11	<0.05	<0.05	<0.05	<0.05	<0.05	0.08	<0.05	<0.05	<0.05	<0.50	<0.50
F2381P	R5ABFO 21	0.08	<0.05	<0.05	0.27	0.10	0.21	<0.05	<0.05	<0.05	0.58	<0.50
F2404P	R5ABFO 21	0.06	<0.05	<0.05	0.21	0.07	0.18	<0.05	<0.05	<0.05	<0.50	<0.50
F2391P	R5ABFO 31	<0.05	<0.05	<0.05	<0.05	<0.05	0.14	<0.05	<0.05	<0.05	<0.50	<0.50
F2405P	R5ABFO 31	<0.05	<0.05	<0.05	<0.05	<0.05	0.10	<0.05	<0.05	<0.05	<0.50	<0.50
F2406P	R5ABFO 31	<0.05	<0.05	<0.05	<0.05	<0.05	0.07	<0.05	<0.05	<0.05	<0.50	<0.50
F2394P	R5ABMO 09	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.10	<0.10
F2407P	R5ABMO 09	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.10	<0.10

FISH & WILDLIFE SERVICES - CATALOG # 5814
QA/QC PESTICIDE AND PCB ANALYSES

FILE #	DESCRIPTION	SAMPLE WT (grams)	ALPHA BHC	HCB (CL2)	BETA BHC	GAMMA BHC	DEL BHC	HEPTA-CHLOR	ALDRIN	HEPTA EPOXIDE	GAMMA-CHLORDANE	ALPHA-CHLORDANE	TRANS-NONACHLOR
SPIKED SAMPLES													
AMOUNT SPIKED (ug)			0.04	0.04	0.04	0.05	0.04	0.04	0.05	0.05	0.04	0.04	0.04
F2406P	ORIG SAMPLE	0.56	0.0006	0.0022	0.0000	0.0000	0.0000	0.0000	0.0000	0.0020	0.0000	0.0000	0.0000
Q6814P	SPK SAMP F2406P	0.56	0.0423	0.0200	0.0501	0.0662	0.0031	0.0643	0.0811	0.0986	0.0746	0.0651	0.0635
RECOVERED SPIKE (ug)			0.0233	0.0099	0.0281	0.0371	0.0017	0.0360	0.0454	0.0541	0.0417	0.0365	0.0356
% RECOVERY			54	24	63	82	4	86	97	117	103	83	80
AMOUNT SPIKED (ug)			0.04	0.04	0.04	0.05	0.04	0.04	0.05	0.05	0.04	0.04	0.04
F2403P	ORIG SAMPLE	0.55	0.0003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0057	0.0007	0.0000	0.0000
Q6811P	SPK SAMP F2403P	0.50	0.0499	0.0044	0.0548	0.0707	0.0017	0.0782	0.0876	0.0895	0.0753	0.0827	0.0941
RECOVERED SPIKE (ug)			0.0248	0.0022	0.0274	0.0354	0.0008	0.0391	0.0438	0.0419	0.0373	0.0413	0.0471
% RECOVERY			58	5	61	78	2	93	93	91	92	94	106
SPIKED SAMPLES													
AMOUNT SPIKED (ug)			2.1450	2.0450	2.2450	2.2700	2.1300	2.1050	2.3449	2.3100	2.0200	2.2050	2.2150
Q6842P	SPK BLANK		0.8447	0.6440	1.7530	1.5241	0.0231	2.1238	2.4230	2.3450	2.0532	2.2187	2.1419
% RECOVERY			39	31	78	67	1	101	103	102	102	101	97

FISH & WILDLIFE SERVICES - CATALOG # 5814
QA/QC PESTICIDE AND PCB ANALYSES

DIELDRIN	ENDRIN	MIREX	2,4' DDE (O,P' DDE)	4,4' DDE (P,P' DDE)	2,4' DDD (O,P' DDD)	4,4' DDD (P,P' DDD)	2,4' DDT (O,P' DDT)	4,4' DDT (P,P' DDT)	TOTAL PCB % RECOVERY
0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.05	0.04
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0013	.00
0.0834	0.0820	0.0787	0.0878	0.0984	0.0598	0.1033	0.0950	0.0983	0.08
0.0467	0.0459	0.0441	0.0492	0.0551	0.0335	0.0578	0.0532	0.0543	0.0420
108	109	105	110	130	78	133	122	117	99
0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.05	0.04
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0051	.00
0.0887	0.0682	0.0624	0.0900	0.0824	0.0961	0.1138	0.0935	0.1037	0.10
0.0444	0.0341	0.0312	0.0450	0.0412	0.0481	0.0569	0.0467	0.0493	0.0479
103	81	74	100	97	113	131	107	107	113
2.1550	2.1050	2.1050	2.2450	2.1150	2.1350	2.1700	2.1750	2.3150	2.12
2.2662	1.9190	2.1742	2.3469	2.9739	2.1176	2.1546	2.1844	2.1855	1.96
105	91	103	105	141	99	99	100	94	92